Chemical Age

FLUORO-CARBONS FROM COAL

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7 February 1959

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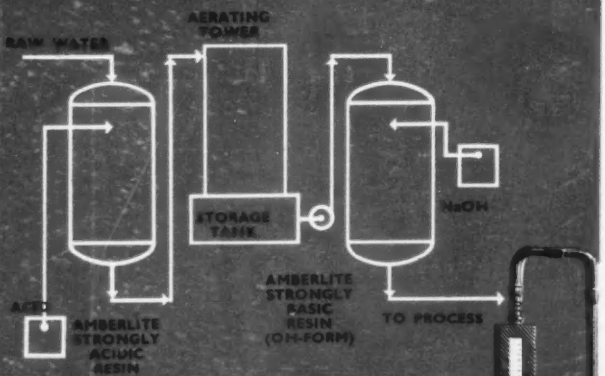

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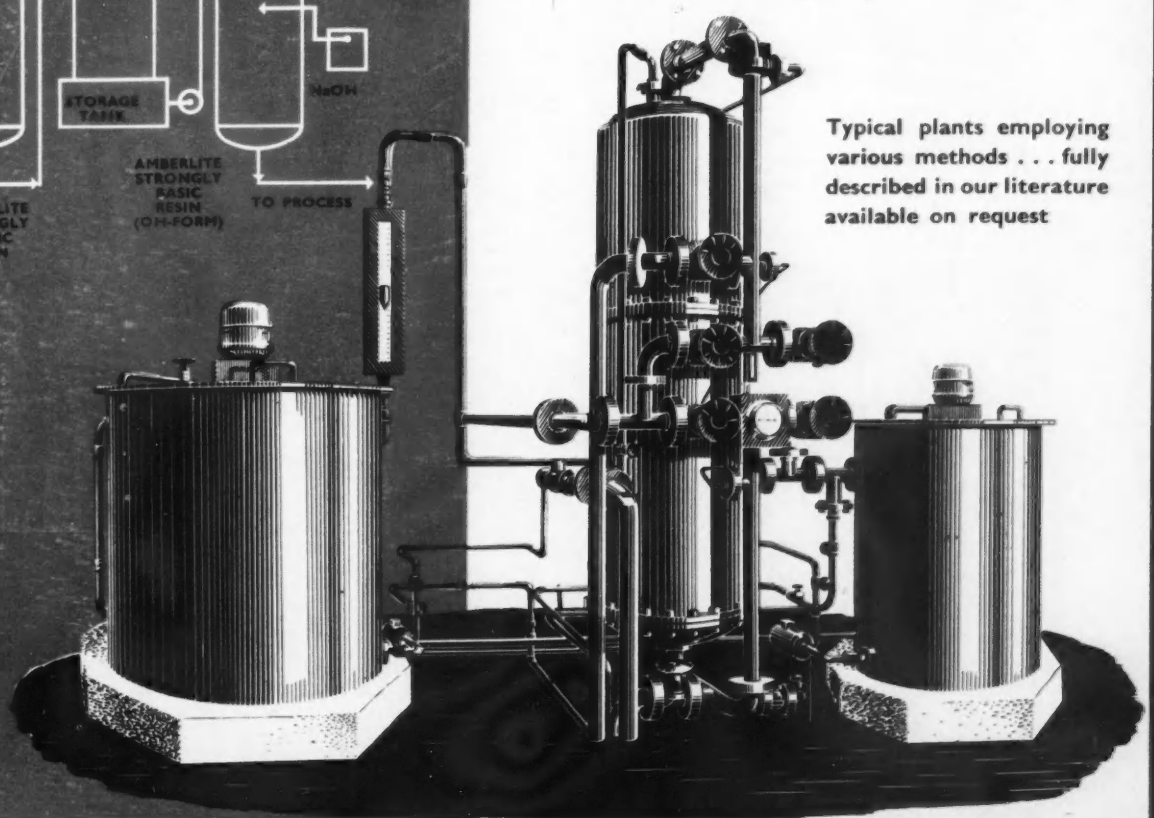

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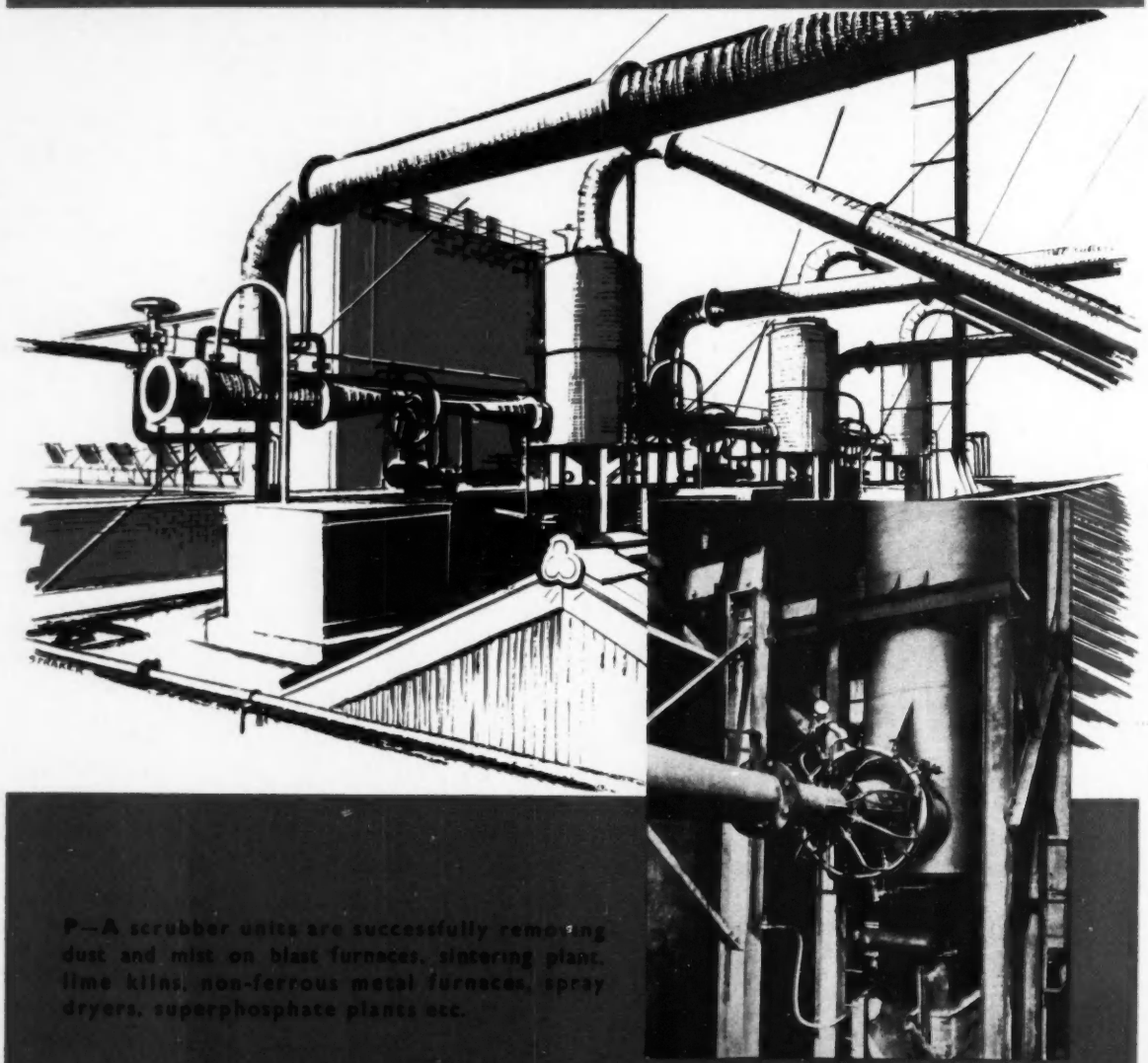

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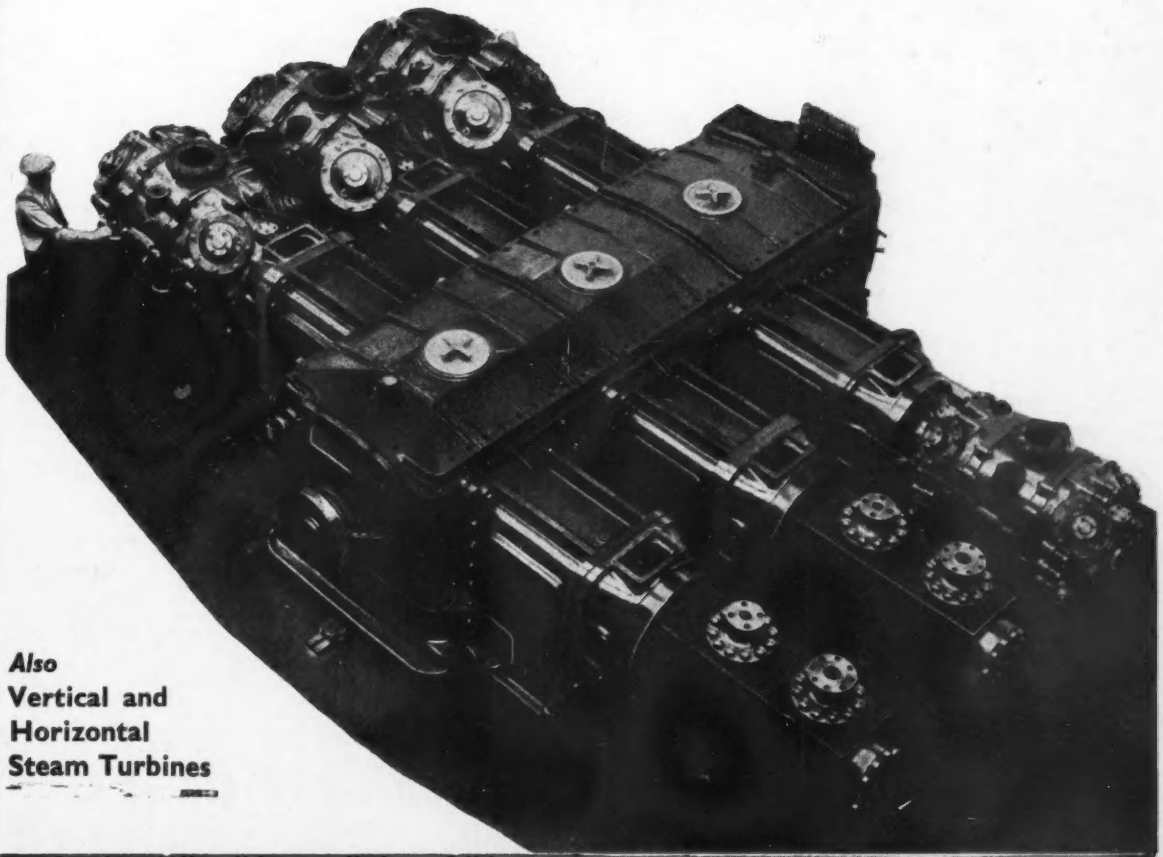

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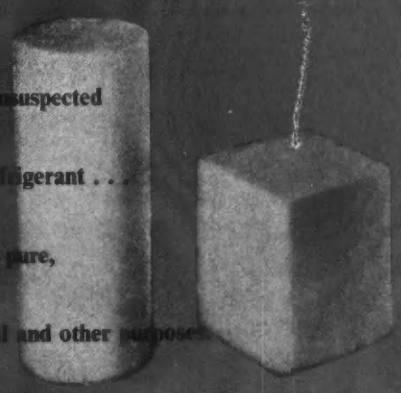

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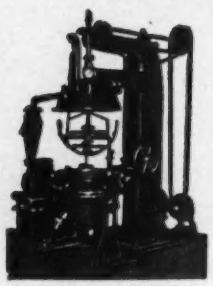

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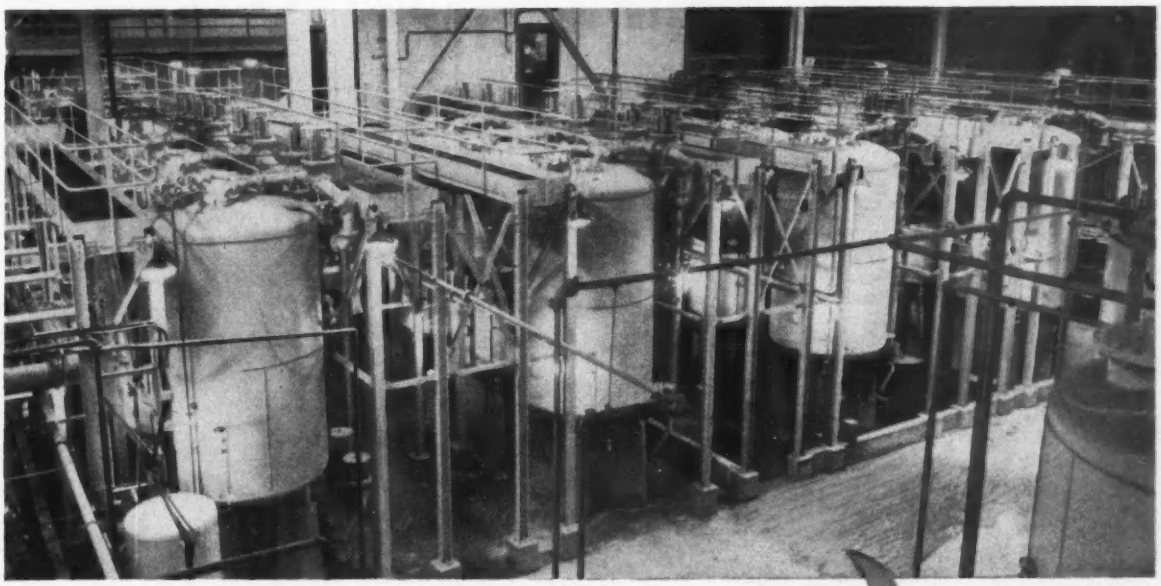

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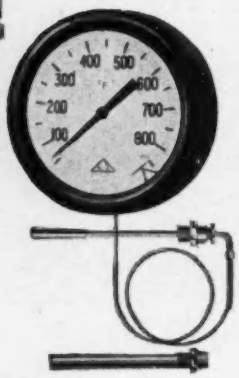

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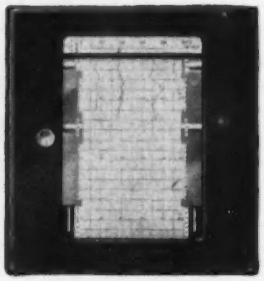

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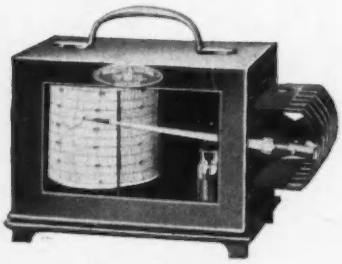

Bi-metallic Recording
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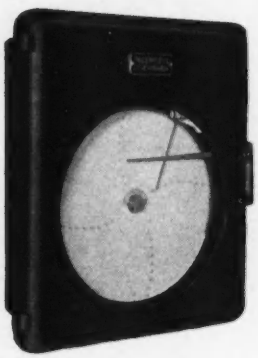

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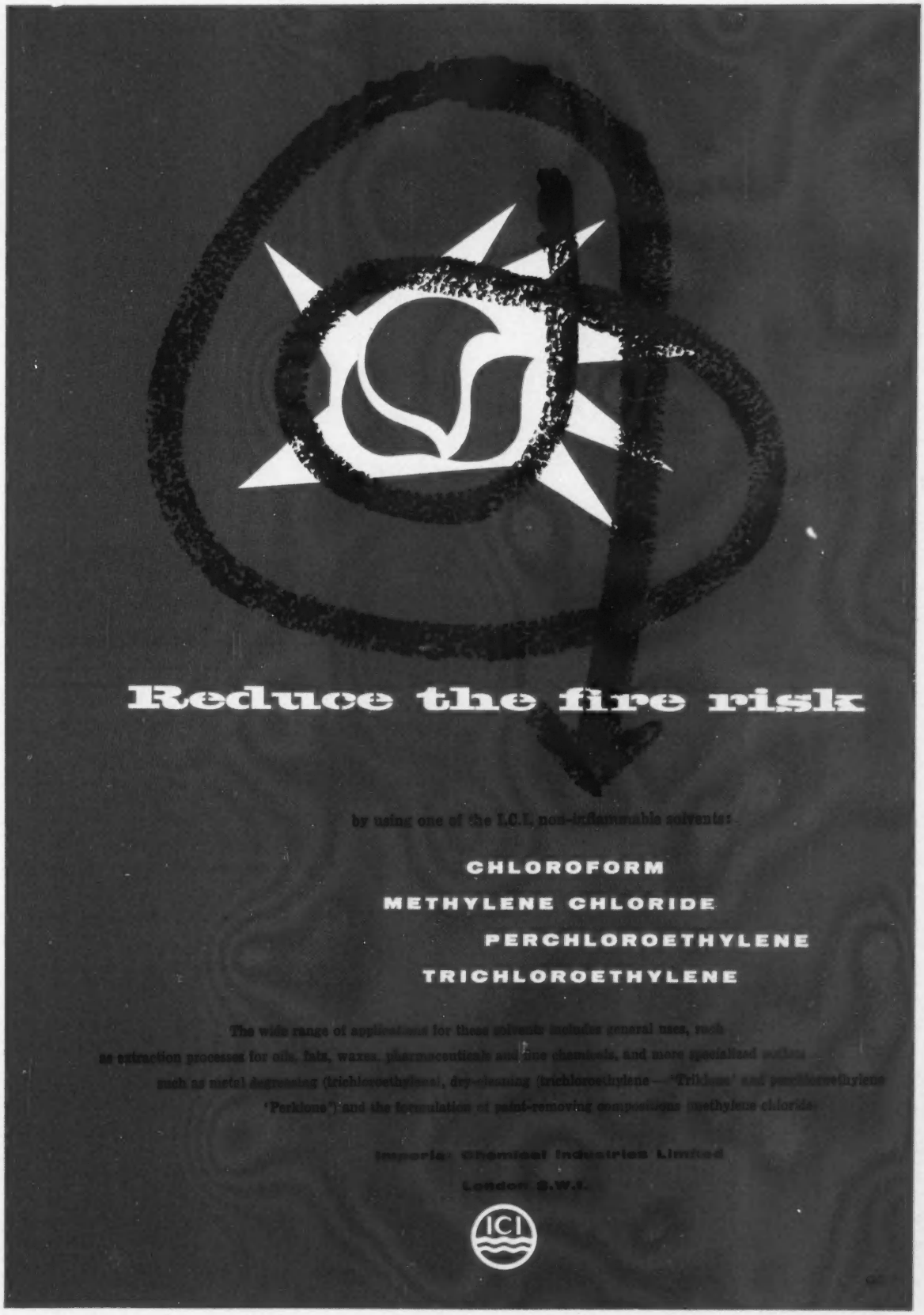
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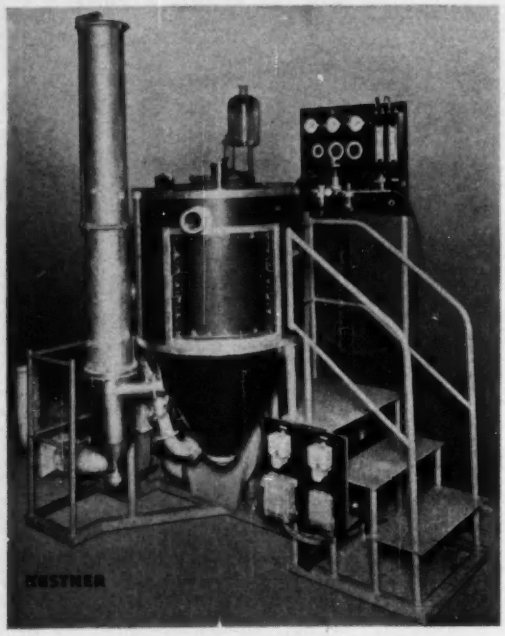

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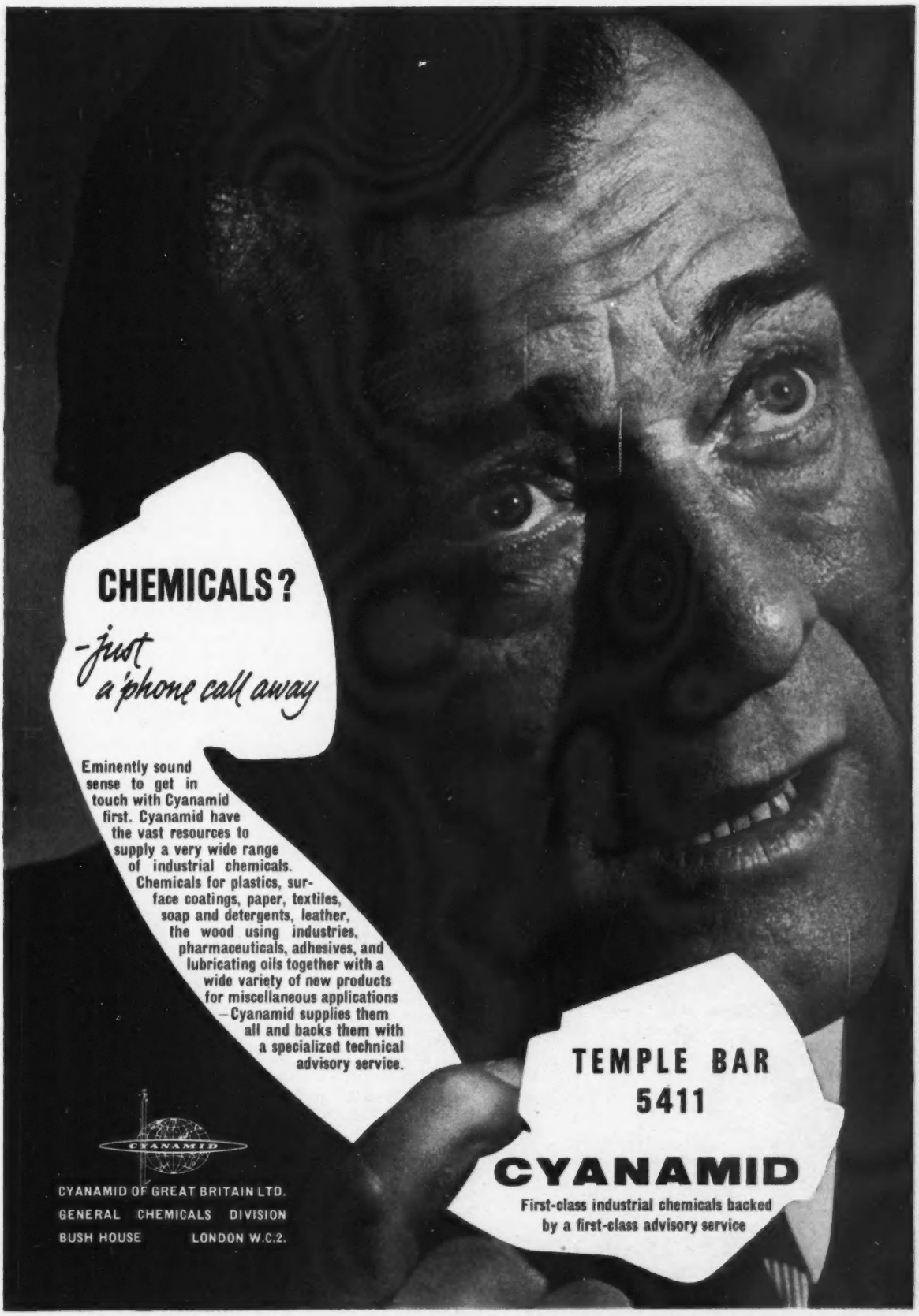
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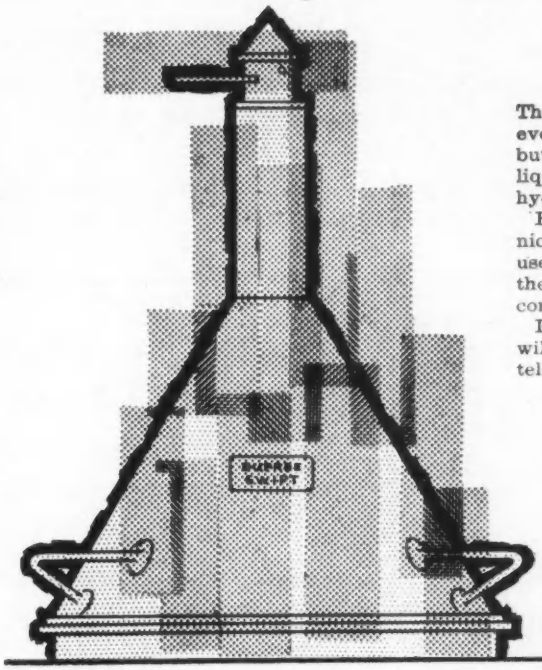

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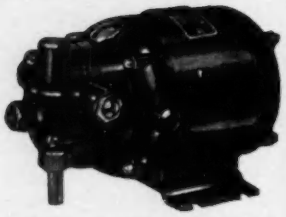

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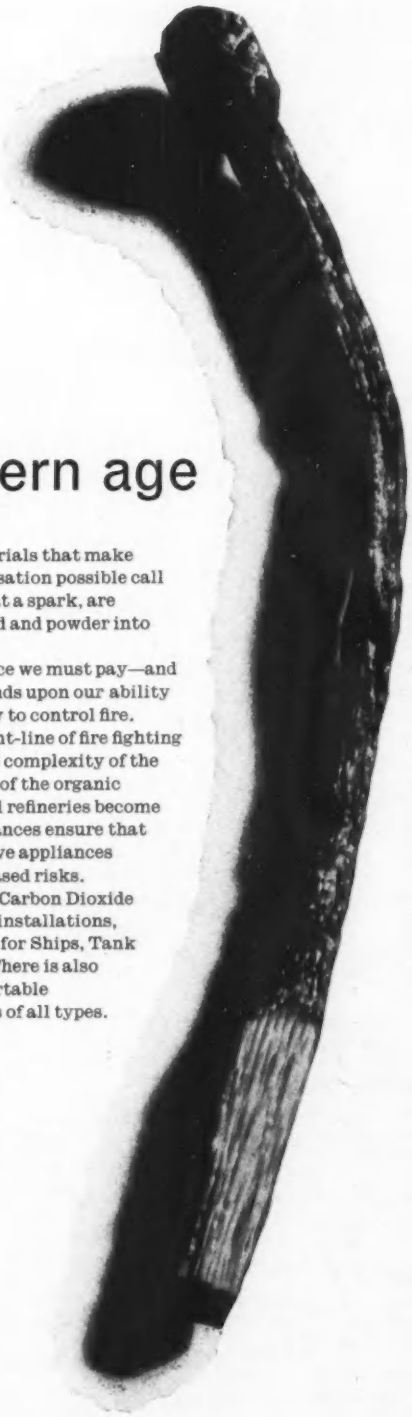

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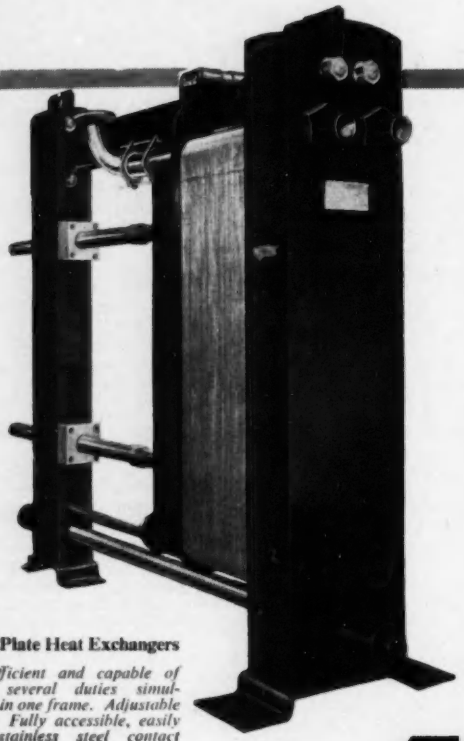

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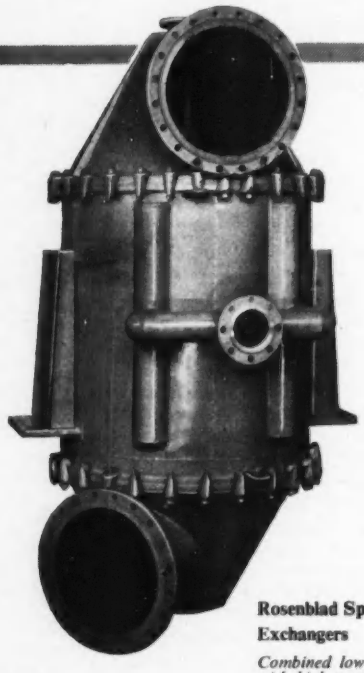

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Midland Office
Daimler House, Paradise Street, Birmingham. [*Midland* 0784-5]

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CHEMICAL AGE

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FACT OR FICTION?

FULL transcript of Mr. Khrushchev's lengthy speech at the opening of the 21st Soviet Communist Party Congress in Moscow last week shows that he made many references to the U.S.S.R.'s chemical industry. Because his remarks represent the first reference in many cases to individual items in Russian plans for expanding chemical outputs, his speech is summarised here.

British chemical manufacturers will, however, doubtless treat the Soviet Premier's claims with the reserve they normally accord to the expansion plans announced by communist controlled states from time to time. Although target figures frequently represent pious hopes rather than practical estimates and although it is often difficult to differentiate between fact and fiction, there can be no doubt that Russian political leaders are quite serious in their intention to effect a rapid growth in chemical and plastics facilities.

Khrushchev stated that a particularly rapid development of the chemical industry was contemplated under the current seven-year plan which ends in 1965 and he stressed that the total output of chemical products must increase almost threefold in that period.

At the beginning of 1958, the Supreme Soviet approved a 1959 budget of some £59,000 million. Scientific research spending will it is now claimed rise to £22,500 million and industrial expansion will take £40,300 million, including a first instalment of the £8,300 million to be spent on the seven-year expansion programme for chemicals. Under the plan, 140 large new chemicals plants are to be built and 130 rebuilt.

The target for mineral fertilisers is 34 million tons in 1965, compared with 12 million tons in 1958. Priority is to be given to developing oil and gas extraction and refining. Oil production is to rise to 240 million tons, more than double the present figure, and natural gas output is to be increased to about five times to reach 150 million cubic metres a year. Much of the £9,000 million scheduled for the petroleum industry will go into petrochemical production. In addition, about half of all the chemical allocations will be earmarked for plants to produce alcohol, plastics, synthetic fibres and synthetic rubbers.

Nearly half (40%) of all capital investment under the Soviet plan is to be directed to the eastern part of the country and the chemical industry will become one of the most important industries in Siberia.

In the large republic of Kazakhstan, capital investment in chemicals is to be increased by 600%. Production of artificial fibres—already in progress—is to be increased tenfold. Synthetic materials will be produced from by-products and waste from the synthetic rubber plant at Temir-Tan in central Kazakhstan. Phosphate deposits in the Karatan mountains will be used for the production of mineral fertilisers.

In Uzbekistan, to the south west, the Fergana oil refinery which the U.S.S.R. claims is the largest in Central Asia is to start operating within the next three months. Output is expected to be 400,000 tons of oil products this year. Use of natural gas for fertiliser production is to be more than doubled within the next seven months.

Output of chemicals is scheduled to increase more than threefold in the

next seven years in Turkmenia, which borders on Persia and Afghanistan. This year, the Soviet Union's first plant for making sulphanol detergent will be commissioned at Krasnovodsk, a cotton-growing centre.

Factories to produce acetate silk and dyes are reported to be under construction in Armenia. Krushchev's plan envisages an increase of 900% in the output of synthetic rubber and plastics. Natural gas from Azerhaijan is to be used in the production of some of these synthetic materials.

The Soviet Government claims that last year the chemical industry reached its target for "the most important products". According to the last report of the U.S.S.R. Central Statistical Board, output of synthetic resins and plastics and synthetic fibres was greater than planned and considerably more than in 1957. Production targets for fertilisers, caustic soda, soda ash, synthetic ammonia and sulphuric acid (4.8 million tons) were reached.

It is stated the cost of producing ammonia at the Stalinogorsk Chemical Combine has been nearly halved, by switching from metallurgical coke to natural gas.

It is claimed also that new kinds of high molecular resins, plastics, dyes, chemical weedkillers and insecticides are being produced in the U.S.S.R. For dyeing fabrics new faster dyes and technical processes have been developed. A large increase in production of chemical and oil equipment is claimed, too.

From this it would appear that Russia is developing her chemical industry at a rapid pace. Since 1951, U.S.S.R. industrial output has been estimated as growing at the rate of 9 to 10% a year (12% according to the Russians), compared with the 3% for U.S. output.

The question now being asked is "Can Russia maintain its present growth rate?" If it can, it will eventually overtake the U.S. as the leading chemical producer, but certainly not by the end of the seven year plan, i.e. 1965. It is noticeable, however, that even according to Russia's own figures, its industrial growth rate as a whole is slowing down (it dropped to 10% in 1957) and is expected to average 8.8% throughout the next seven years.

A noticeable feature of Krushchev's report is that chemical expansion plans for the most part are reported in vague terms, that is, as percentages or as threefold or tenfold present production. And there are no figures for present production in most instances!

RUSSIA'S DIFFICULTIES

Last year, this journal reported on difficulties in the Soviet chemical industry. These still seem to be prevalent. There have been complaints recently that in some cases building work on new chemical plants has been behind schedule. The Communist Party newspaper *Pravda* drew attention to this some months ago. It blamed the situation on delays in providing technical blueprints and the workers on the sites and on inadequate supplies of the necessary equipment (to help implement chemical expansion, Russia plans to set up 14 new equipment-producing plants and modernise some 40 others).

Last month, the head of the State Committee for Chemical Industries, Mr. Fedorov, complained that Russian research chemists had not yet evolved reliable data for the industrial production of acetylene from hydrocarbon raw materials and for glycerine and some other chemicals.

Following Khrushchev's speech, L. N. Yefremov, from the Gorky region, stressed the importance of oil chemistry for the production of synthetic materials, but added that this question had yet to be solved. For instance, the Novogorkovsky Oil Refinery had started operating, but no plan existed for processing the valuable chemical raw materials produced there. The region received ammonia from other regions, although it was possible to produce it on the spot from natural gas in quantities which would fully satisfy its needs.

Another problem facing the Russians is the lack of trained scientists for the synthetic fibre and plastics and synthetic rubber industries. The U.S.S.R. has had to seek technical help from its satellites, notably East Germany and Czechoslovakia. But from the various Russian missions sent abroad, it seems that the Soviet requires help from the West.

Management problems also loom large. The State Committee for Chemical Industries replaced the Ministry for Chemical Industry in the hope of clearing up the difficult situation in which the Ministry had involved itself.

Deputy-Premier Mikoyan's recent visit to the U.S. was obviously designed to gauge U.S. chemical and allied industries' attitude to the U.S.S.R. Russia wants U.S., U.K. and West German equipment and technical know-how as well as easing of East-West trade restrictions. It needs all these to surmount its difficulties and to enable it to catch up with these countries' chemical industries.

A survey of major sections of the chemical, petroleum, synthetic fibre, rubber and pharmaceutical industries was carried out by *Chemical and Engineering News* (1958, **37**, No. 4, 22) during Mikoyan's visit. This shows that more trade with the U.S.S.R. is opposed by 60% of U.S. chemical industry; 37% favour it; and 3% have no opinion. More trade with Red China is opposed by 60%; 23% want trade; and 17% have no opinion. Trade with satellite countries, however, had 53% approval; 37% said no; and 10% had no opinion. With regard to selling chemical processes 80% are opposed to selling these to the U.S.S.R., 13% say yes; and 7% have no opinion.

No such survey has been conducted in this country, but it would seem that similar opinions would result. There are indications, however, of more U.K. companies selling equipment to the U.S.S.R. and of assisting in setting up certain types of factories.

U.S. chemical manufacturers are concerned about threats of Soviet competition, and the use of economic warfare. Viewing this rationally, it would seem that in the export field, while certain chemicals in oversupply in the U.S.S.R. might be released on the world market, the present Soviet plans as outlined by Mr. Khrushchev will require the chemicals for internal use. Plastics development in the U.S.S.R., for instance, which the U.S. regards with concern, has a long way to go to catch up with that of Western Europe and the U.S. Also when adequate production is available in the U.S.S.R. it will be needed in constructing the "homes for all" cry of Khrushchev. Similarly, synthetic fibres are desperately needed to reduce the cost of Russian clothing now exorbitantly priced.

A limited period of pushing of certain chemicals by the Soviet, at uneconomic prices to West European and U.S. eyes, can be expected. But this in the long term is a bad policy, for regular purchasers will tend to fight shy of such offers unless it suits them, because there is no guarantee of future supplies.

Far more of a threat, in our opinion, would be the sale of processes, know-how, and advanced-type equipment. Know-how cannot always be put over in writing; it needs highly skilled technical experts on the spot, for long periods if needs be. The U.K., the U.S. and West Europe need every skilled man at home. Helping the Soviet get its chemical industry modernised must lead to economic warfare at a much earlier date than that country could hope to reach under present circumstances. It must be obvious to all that a Russion state-controlled industry has marked advantages over the private enterprises of the U.S., the U.K., West Germany, France, and Italy. The sale of a few hundred million pounds' worth of specialised equipment or of processes to Russia is not going to be worthwhile in the long run, particularly if West Europe and the U.S. cannot develop at an even faster rate than Russia

FLUOROCARBONS FROM COAL

Possibilities of New Single-stage Process Developed by B.C.U.R.A.

RESEARCH in the British Coal Utilisation Research Association's (B.C.U.R.A.) laboratories, Randalls Road, Leatherhead, Surrey, has opened for the first time the possibility of making stable transparent oils from coal at ordinary pressure in a single stage process. Reacting low-rank coal with gaseous chlorine trifluoride diluted with nitrogen, is reported as giving good yields of highly halogenated products. The research was initiated by Dr. I. G. C. Dryden and supervised by R. L. Bond.

Investigators at B.C.U.R.A., P. J. Farenden and E. Pritchard, have used a low-grade Northumberland coal, since it seemed likely that coal, with a molecular structure probably containing condensed aromatic rings, might on fluorination yield a great proportion of higher boiling products.

Fluorinating Agent

Chlorine trifluoride, liquefied, having a boiling point of 11.3°C has been chosen as the fluorinating agent because of the comparative ease of handling. The chlorine trifluoride diluted with nitrogen is passed through a heated bed of coal. It has proved necessary to break up the coal mass to prevent coalescence on heating. In the early experiments this was achieved by adding alumina chips (−4 +8 B.S.S.) to the coal when packed in the reactor. A 2-in. layer of chips was also added on top of the coal bed to filter out very fine coal, which otherwise tended to get blown into the traps of the apparatus. Calcium fluoride chips were also tried as a bed expanding material since it was noticed that when fresh chips were used no oil was produced, but the yield of oil improved with repeated use of the same chips. Again, after an initial increase in oil production, there was a subsequent decline in yield. Pieces of scrap nickel were then used.

To eliminate the variable effect of the bed-expanding material, partitioning rings of nickel gauze, 2½ in. diameter, have been used to break up the coal bed. They have been given a standard flaming and abrading treatment between successive experiments.

An all-nickel apparatus has been designed and consists of a reactor 2½ in. in diameter and 1 ft. long with a heated exit tube (>300°C) and nickel traps which are cooled to −75°C. The traps have nickel-foil tops held in position by a spring-loaded open ring. Reactor and traps are housed in a box of 16-gauge steel sheeting with Perspex windows in each side. Holes, 2 in. in diameter in the Perspex allow the traps to be opened and inspected using remote handling tongs.

The most suitable operating conditions have proved to be a combination of the intermediate values of the three variables, namely, 360°C., 45% ClF_3 v/v and 500 ml./min. total gas flow. Yield of oil with such a combination has been 80.1 ml. and the residue (mainly inorganic material) remaining 38 g. after 16.7 hours of reaction. This has given a carbon efficiency of 50% and a fluorine efficiency of 19%.

Farenden and Pritchard believe, however, that the fluorine efficiency could be improved, since blow holes had formed in the coal bed in all the experiments carried out.

From experimental results it is noted that although the empirical formulae of the oils produced expressed as C_xH_y $Halogen_z$ were very similar ($C_1H_{0.05-0.15}Hal_{1.62-1.72}$) the atomic ratio of F/Cl in the oils increased with increase in reaction temperature (9.5:1 to 21:1). The viscosity of 100°F of the oils decreased with increasing reaction temperature. This is considered to be possibly the result of increased disruption of C—C bonds of the coal structure at higher reaction temperatures, although alternatively it could be due to thermal degradation of polymer units, which are stable at the lower reaction temperatures.

The chief product produced using this process is an oil (approximate analysis C 25%, F 65%, Cl 7%) having a wide boiling range (80% within 150° to 350°C at atmospheric pressure). Smaller quantities of a thermoplastic resin and material of a waxy consistency are also obtained.

Properties of the Oils

Properties of the oils have been described by Farenden and Pritchard. Specific gravity 60°/60°F of the oils is high and all determinations lie in the narrow range 2.01 to 2.07. Viscosities of the oils at 100°F have a wide range from 17 to 391 cS. Calculated viscosity indices for 10 oil samples have a range in value from −274 to −938. Change of viscosity with temperature of the oils is greater the higher the viscosity of the oil at 100°F. Refractive indices of the oils at 25°C. with reference to the sodium D line are low compared with organic material, not containing high percentages of fluorine, of comparable molecular size and range from 1.344 to 1.371.

Analysis of the oil has shown that carbon and hydrogen values are fairly constant at 24 to 24.5%, and 0.1 to 0.4% respectively. Fluorine percentages vary from 60.1 to 72.0 and chlorine percentages from 2.0 to 11.7. The sum of fluorine + chlorine is stated to almost invariably be between 72 and 74%. A determination of the electrical resistivity of one oil sample gave a fairly high value of 10^{11} ohm-cm.

It is considered that while the low-rank Northumberland coal has yielded moderately large yields of highly halogenated oil, it might be possible to increase the fluorine efficiency by use of coals of high-rank or of low-rank coals precarbonised to higher temperatures. These materials, having lower hydrogen contents, would give rise to less unwanted hydrogen fluoride and hydrogen chloride and so would require less fluorinating agent per unit of coal consumed. Another possible way of decreasing the requirement of fluorinating agent might be to prechlorinate the coal. Experiments have been done whereby up to 40% of chlorine has been introduced into low-rank coal by reaction with chlorine gas and air at 270°C. (F. J. Pinchin). Hydrogen content of the coal fell from 4.8% to 1.1%. A combination of this technique and of the present process, it has been suggested, might prove rewarding.

The highly fluorinated products obtained by the B.C.U.R.A. process are stated to have properties similar to those of perfluorocarbons, e.g. marked thermal stability and chemical inertness, non-flammability, high density, low surface are also reported to be extremely hydrotension and low refractive index; they are also reported to be extremely hydrophobic. Among possible uses suggested are the following: as hydraulic fluids in systems where fire hazards are large; as heat transfer fluids, especially in the range immediately above 200°C; as lubricants in valves, pumps, etc., handling corrosive fluids, as surface coatings; and as transformer and switchgear oils. Gaseous products of the reaction, as yet uninvestigated, may contain low molecular weight chloro-fluorocarbons similar to those used as refrigerants and aerosol propellants.

I.C.I. Announce U.K.'s First Bulk Production of Silicon

A LARGE-SCALE development plant for the manufacture of high-quality silicon of semi-conductor grade has been brought into operation by I.C.I.'s General Chemicals Division. This material, which costs over £100 per lb., has become of commercial importance during the past few years in the manufacture of semi-conductor devices, such as transistors, which are replacing thermionic valves in many applications.

The I.C.I. plant, situated on Merseyside, will by the middle of this year have a capacity approaching 4,000 lb. per annum. Plans for much larger production are well advanced.

Lump silicon, *p*-type, of resistivity greater than 200 ohm. cm. is now available in quantity. Silicon in rod form, deposited direct from vapour and of exceptionally low boron content, is being produced in limited quantities in lengths of 24 in. and diameters up to 1 in. These rods are suitable for zone refining.

If there is a demand I.C.I. will supply silicon in rod form already zone refined into single crystal rods. Much of the silicon used in Britain comes from the U.S. or France. Now I.C.I. will be able to satisfy the home demand and later expect to export silicon.

★ LURID reports in London evening newspapers on Monday this week spoke of an explosion at the inorganic chemical laboratories of the Imperial College. Mention was made of injuries to Dr. E. W. Abel, of students being involved, dangers of radioactivity, etc.

The explosion occurred in a laboratory attached to the Inorganic Chemistry Department, head of which is Professor G. Wilkinson. Dr. Abel, aged 28 and a Doctor of Science, was slightly injured with cuts and burns; he was taken to hospital and discharged on Tuesday. He was working alone at the time on an experiment when an explosion blew out windows and was followed by a rapidly spreading fire which damaged walls and ceilings. Also damaged was Professor Wilkinson's office, next door to the laboratory. The fire was quickly quelled by staff, students and the London Fire Brigade.

Dr. Abel was working under Professor Wilkinson on a post-graduate research fellowship. Until his work is published, the College is not at liberty to say what caused the explosion.

★ I HAVE long advocated simplicity in typography if only in the cause of greater readability. That is why I welcome the new covers which the Society for Analytical Chemistry has adopted with the January issue of *The Analyst* and *Analytical Abstracts*. A glance at the cover of *The Analyst* of only 11 years ago shows a total of 254 separate printed items, including 150 full words, 10 abbreviations, 15 numeral groups, 78 groups of honours or qualifications, etc. This was roughly halved in 1948 and again in 1950. Now that the clutter of printed matter has been banished from the cover, only 40 items of lettering remain.

Editorial of the January issue states "If this new look is reflected in the further simplification of the analyst's task by the discovery of some fundamentally new techniques—and if we are privileged to publish them—we shall be satisfied."

★ A SEEMINGLY anomalous situation under which it appears that lithium carbonate can be exported to Poland but not to other Sino-Soviet bloc countries was discussed in question time in the House of Commons last week. Sir David Eccles, President of the Board of Trade, told Mr. E. Davies (Lab., Enfield E.) that the only licence that had been granted for Poland related to a small quantity of lithium carbonate worth 7s., which had been included in a parcel of laboratory chemicals.

Mr. Davies said that a British firm had received an order for a considerable quantity of the material from Hungary "to be used in the manufacture of T.V. tubes." He added that the licence was refused and that the firm was told by the B.o.T. that it could export to Poland. Mr. Davies asked: "Is it not ridiculous that one member of the Soviet bloc can purchase this compound and the other cannot?"

Sir David pointed out that the order from Hungary was for a considerable quantity of material which was very important in the field of nuclear fission. When asked what harm there could be in licensing the material for use in T.V. tubes, Sir David replied that it was impossible to export strategic materials under guarantees of end-use.

★ THE U.S. Government states that a vote will shortly be taken in Congress on whether the Government should sell its 93% holding in the General Aniline and Film Corporation. The Corporation was taken over by the Government during World War II on the grounds that it was a company in German hands. Objections have been made to the Government's holding of the corporation by the Swiss company Interhandel, which says that the company was in Swiss, and not in German, hands on its take-over.

With this Swiss claim outstanding the company's shares can not simply be sold as would be the case were there no such objection. Despite the claim, however, Congress is in a position to authorise the sale of General Aniline shares. Sale, if it takes place, is likely to be by open subscription. In the case of the sale taking place, a part of the accruing money would be put into reserve to cover any such claims as might be granted.

★ THE increasing use of stainless steel in chemical plant lends importance to a novel and patented process known as 'electro-polishing'. The stainless steel article to be polished is immersed in an electrolyte and a current is passed through it, using the article as the anode. Instead of depositing metal on the article, as in electroplating, the process is reversed and about 0.0005 in. is removed electrochemically and evenly from the stainless steel. A highly polished and chemically clean surface remains.

Besides being cheaper and quicker than mechanical polishing, electro-polishing has other advantages. Any inclusions in the stainless steel, which are sometimes unavoidably introduced during manufacture, are removed electrochemically, instead of being added to, as they tend to be by mechanical polishing. The electro-polished article is therefore particularly resistant to corrosion, which makes it suitable for components where chemical purity and hygiene are paramount. Secondly, complex assemblies, which would be inaccessible for mechanical polishing, can be readily electro-polished. This in turn frees design, because there is no need to avoid shapes which previously have proved difficult or impossible to polish by any other method.

A wide variety of articles of all shapes and sizes has been successfully treated by this process by Electropol Processing Ltd., Trading Estate, Farnham, Surrey, varying from stainless steel tanks of 2,000 gall. capacity to small parts of cathode-ray tubes and wireless valves; and work has been carried out for Kodak, I.C.I., and many other firms.

★ USERS of Diakon, an I.C.I. thermoplastic material, can now colour their products to the exact shade they desire by blending uncoloured polymer, the fine powder form, with dry pigments in a tumbler. Diakon is a polymethyl methacrylate available also in regular cut form (compound). Up to now coloured forms could only be supplied as compound. Colour blending by the moulders themselves is particularly useful in short production runs or experimental work.

I.C.I. Plastics Division claim that recent price reductions have made this polymer the cheapest acrylic moulding and extrusion material available. Diakon is used extensively in the motor industry and increasingly for lighting fitments and telephones, for instance the new G.P.O. coloured hand-sets. It also figures in fountain pen barrels, cigarette holders, shavers, brush backs, radio knobs, typewriter keys, meter wheels, cosmetic containers and buttons.

★ CHEMICAL AGE receives a regular flow of inquiries from its readers, the main subjects being new developments in processing techniques, chemical engineering or analytical chemistry that have been mentioned in our pages; production figures for U.K. chemicals and minerals; sources of supply; and prices—in that order.

Those who make use of this service, which is free to readers, will know that we are seldom unable to answer an inquiry. However one that has had CHEMICAL AGE staff stumped came from a chemical manufacturing concern in the Midlands which wishes to obtain spray drying facilities on a commission basis as near as possible to one of its subsidiary factories in the Midlands. I should greatly appreciate it if any of my readers could suggest the name of a firm that could undertake this work.

Alembic

W. GERMAN SULPHURIC ACID INDUSTRY IS CONCENTRATED ON I.G. FARBEN SUCCESSORS

WEST Germany's sulphur industry, today the largest in Europe, is comprehensively reviewed in the latest issue of *Sulphur* (1958, No. 23). According to the report, sulphur production totals about 560,000 metric tons, and consists of recovered elemental sulphur, sulphur in pyrites and spent oxide, by-product sulphuric acid manufactured from coal- and oil-derived hydrogen sulphide, and from sulphur dioxide in metal smelter gases.

Consumption of sulphur in all forms reached the highest level on record in 1957 when it totalled nearly 1.2 million tonnes. West Germany is mainly dependent on foreign sources of sulphur, only some 45% of her needs being met from domestic resources. In contrast to the U.K. where use of pyrites for sulphuric acid manufacture was abandoned nearly 20 years ago, West German sulphuric acid manufacture continues to use pyrites. The physical and financial integration of sulphuric acid manufacture, however, has placed the costing of sulphur in pyrites on an entirely different economic plane.

End-uses for Sulphur

Of the 560,000 tons of sulphur produced in 1957, 11% represented recovered elemental sulphur, 43% pyrites, 8% spent oxide and 35% by-product sulphuric acid derived from hydrogen sulphide extracted from coal gases and SO_2 in melter smelter gases. Last year, domestic sources were augmented by using copperas from titanium dioxide manufacture, some 18,000 tons sulphur equivalent being recovered and used in sulphuric acid manufacture (see also CHEMICAL AGE, 1958, **80**, 680, referring to a recent British Titan Products patent).

Over the past 10 years, *Sulphur* reports, indigenous supplies in West Germany have grown by nearly one-quarter million tons or 75%. It is noted that the main development that is now taking place is the growth of recovery of sulphur at oil refineries which is expected to double within the next three to four years.

Total pyrites production in 1957 was 605,000 tonnes containing about 241,000 tonnes sulphur. The 1958 output is expected to be 5 to 8% lower.

Recovery of sulphur from coal, oil refinery and metal smelter gases provides nearly three-fifths of West Germany's indigenous sulphur supplies. It is estimated that last year the equivalent of about 320,000 tonnes of sulphur was thus provided.

The old-established metal smelting industries are stated to supply nearly half of recovered sulphur supplies in the form of by-product sulphuric acid (an output of 450,000 tonnes, 100% H_2SO_4). Zinc and copper smelting yields most SO_2 but lead and tin smelter gas are also used. In addition some 1,800 tonnes of liquid SO_2 is produced annually by the Sulfidin process and up to 6,000 tonnes contact acid is recovered from sludges in a Wiley retort.

Purification of coal gas at town gas works, and at coke ovens has reached in Germany, a higher level of efficiency and diversity of processing than in any other country's coal industry.

While both wet and dry purification are employed, the most commonly used is the wet method, followed if necessary by dry purification. Most prominent are Badische Anilin- und Soda-Fabrik's Alkazid process, Koppers' hot potassium carbonate process and preferential absorption of H_2S by ammonia as used by Collin, Ibing Pintsch-Bamag and others. In dry purification, natural and synthetic ferric oxide have recently been supplemented by pelletised iron oxide in a process developed by Gastechnik G.m.b.H. Lurgi, Koppers or Chemiebau wet contact plants convert concentrated H_2S on site to sulphuric acid. Or H_2S is burnt to SO_2 and converted to elemental sulphur in a Claus kiln.

Two central sulphur recovery plants operated by Ruhrgas A.G. and Thyssensche Gas und Wasserwerk, provide about 37,000 tonnes sulphur a year, equal to 46% of West German elemental sulphur output. Under one-half of sulphur extracted from coal gas by dry purification is recovered in elemental form, the rest of it arising as spent oxide with 42 to 49% sulphur being burnt and converted to sulphuric acid. In 1957 this amounted, *Sulphur* reports, to some 46,000 tonnes sulphur contained in about 110,000 tonnes spent oxide.

Coke Oven Plants

Output of about 32 coke oven plants adds about 100,000 to 120,000 tonnes acid a year. (Mostly as 60° Bé acid which is used in making ammonium sulphate from by-product ammonia.)

On the verge of rapid expansion are sulphur supplies from West Germany's petroleum industry, which for last year are estimated to amount to about 40,000 tonnes. Plants at present extracting sulphur from refinery gas are Shell (2 plants), Esso, Mobil, British Petroleum, Scholven Chemie and Gelsenkirchen Benzin. Expansion is planned at most of these plants and other units are being built at D.E.A., Purfina and Deurag refineries and by the natural gas producers in Emsland. These are expected to bring sulphur extractions and recovery capacity up to about 75,000 tonnes a year in 1960.

Sulphuric acid output in 1957 totalled 2.7 million tonnes (100% H_2SO_4) with contact plants contributing about 80% of the total acid produced. Installed capacity is estimated today at 3 million tonnes provided by some 37 producers. The acid industry is concentrated, however, between three manufacturers—the successor companies to I.G. Farben.

In post-war years much reconstruction and modernisation has taken place in sulphuric acid manufacturing plants. The greatest development is deemed to be the Badische Anilin und Soda Fabrik's turbulent layer roaster, said to account now for over one-quarter of the installed capacity.

Company	Annual Capacity (CH_2SO_4 100%)	Source	Use
Farbenfabriken Bayer AG ...	780,000 tonnes	Pyrites + 18,000 tons from copperas	80% internal use 20% for sale
Badische Anilin- und Soda-Fabrik AG ...	530,000 tonnes	Pyrites	90% internal use
Farbwerke Hoechst AG	383,000 tonnes	Pyrites	internal use

Consumption of sulphur in West Germany in 1957 reached 1.19 million tonnes and is expected to be in all forms up to 1¼ million tonnes. Eighty-five % (about 1 million tonnes) is used for sulphuric acid manufacture. Non-acid sulphur users consume about 190,000 tonnes. Manufacture of carbon disulphide represents 40 to 45%, closely followed by the pulp industry—about 40%. Other industrial users are rubber 5½%, pharmaceuticals and insecticides 3%, dyes and pigments 3½% and paper 2%. The pulp industry uses pyrites, and the other non-acid industries use sulphur from domestic and overseas sources.

Fertilisers, in particular ammonium sulphate, account for the greater share of West German sulphuric acid, fluctuating between 40 to 44% (43½% in 1957), of this ammonium sulphate takes 34 to 35% and superphosphate 9 to 10%.

Textiles take about 12%, although the 340,000 tonnes (100% H_2SO_4) is bought in. Glantzstoff-Courtaulds, however, are to build a small Chemiebau contact sulphuric acid plant, with production based on elemental sulphur, which is due to come into operation towards the end of this year.

Titanium dioxide manufacture consumes 20,000 tons a month of acid, and the chemical industry about 900,000 tons annually (about 32% of total use).

S.A.C. Annual Meeting

Annual meeting of the Society for Analytical Chemistry will be held in the meeting room of the Royal Society, Burlington House, London W.1, on Friday, 6 March. It will be followed by the address of the retiring president, Dr. J. H. Hamence, at which visitors will be welcome.

In the evening the biennial dinner commemorating the 85th anniversary of the society will be held at Fishmongers' Hall.

Five Mond Nickel Fellowships

Applications are invited by the Mond Nickel Fellowships Committee, 4 Grosvenor Gardens, London S.W.1, for fellowships for 1959. Fellowships, worth £900 to £1,200, will enable applicants to gain experience in industry at home or abroad. It is hoped to award five each year.

SIR HUGH BEAVER IS CHIEF GUEST AT MANCHESTER DINNER

At the dinner, l. to r., Sir Hugh Beaver, president, Institution of Chemical Engineers, who is behind H. E. Charlton, retiring branch chairman; R. J. Kingsley, branch hon. secretary; Professor C. S. Sellers (Professor of Chemical Engineering, University College of Swansea); Dr. W. S. Norman (Manchester College of Science and Technology) and Professor Frank Morton (Professor of Chemical Engineering, Manchester College of Science and Technology), the new branch chairman

THAT the chemical engineer was playing a vital role in the chemical industry's present stage of great and rapid expansion, was a point made by Sir Hugh Beaver, president, Institution of Chemical Engineers, when he proposed the toast of the North-Western branch at its annual dinner in the Midland Hotel, Manchester, on 30 January. Sir Hugh pointed out that the branch now had about as many members as the Institution as a whole had just before the war; that was a sign of the fact that chemical engineering was at last reaching the position which it deserved among the great engineering technologies. The Institution had an increasing role to play in the industrial life of Britain.

Mr. H. E. Charlton (H. E. Charlton Engineers Ltd.), chairman, responded to the toast. Professor Frank Morton, Professor of Chemical Engineering, Manchester College of Science and Technology, proposed the toast of 'Our Guests,' to which Professor E. S. Sellers, Professor of Chemical Engineering, University College of Swansea, responded.

Guests at the dinner included: Dr. B. V. Bowden, principal, Manchester College of Science and Technology, Mr. George Brearley, director, Association of British Chemical Manufacturers; Dr. J. B. Brennan, general secretary, Institution of Chemical Engineers; Dr. E. H. T. Hoblyn, director, British Chemical Plant Manufacturers' Association; Mr. C. S. Rees (Associated Ethyl Co. Ltd.), and Mr. H. Smith, technical managing director, I.C.I. General Chemicals Division.

Annual Meeting

At the annual meeting which preceded the dinner, Professor Morton was elected chairman in succession to Mr. Charlton (see 'People in the News', p. 253).

Presenting the report of the committee, Mr. R. J. Kingsley, hon. secretary, hoped there would in future be even closer contact between the North-Western branch and the Institution. He suggested that once a year there should be a general meeting of the Institution, part-social and part-business.

Following the meeting, members heard Professor E. S. Sellers give a paper entitled 'A chemical engineer looks at systems engineering.' Professor Sellers described this new approach to engineering and spoke of its economic value in chemical processing.

L. to r., H. Kaye (Manchester Oil Refinery), K. M. Hill (U.K. Atomic Energy Authority), G. V. Wolf (Victor Wolf Ltd.) and A. P. R. Strawson (Metallic Construction Co. Ltd.)

Britain Gets Liquid Gas From America

THE first cargo of liquid natural gas ever to be transported by sea left Lake Charles, Louisiana, last Saturday in the converted tanker *Methane Pioneer* for the Thames. The liquid will be reconverted into gas for customers of the North Thames Gas Board.

The gas, about 2,000 tons, is kept at a temperature of minus 258°F at atmospheric pressure in four rectangular aluminium tanks insulated with a 12-in. thickness of laminated balsa wood and enclosed in steel jackets. As a liquid it occupies about 1/600th of the space it fills as a gas.

The *Methane Pioneer* is owned by British Methane Ltd., a company formed by the Gas Council and an American company, Constock International Methane Ltd., who have carried out research and development work for a number of years.

The North Thames Gas Board has constructed two tanks at Canvey Island to take 1,000 tons each of the liquid gas. After reconversion the gas will be delivered by direct transmission pipe to the Romford gasworks, 20 miles nearer London, where it will be reformed to town gas.

If trial runs by the *Methane Pioneer* are successful larger transport vessels may be built.

Kestner's Supply Spray Drying Plant to U.S.S.R.

A LARGE spray drying plant for sodium sulphate is to be supplied by the Kestner Evaporator and Engineering Co. Ltd., London, to the U.S.S.R. This is announced at the end of negotiations with the V/O Techmashimport of Moscow, and delivery will take place this year.

The installation, one of the biggest supplied by Kestner's, will comprise the complete spray drier, all electric motors and product conveying equipment. It will be producer-gas fired and employ a Kestner centrifugal atomisation system.

Production capacity will be about 5,000 lb. an hour of dried sodium sulphate.

Capital Spending in Chemical Industry

FIXED capital expenditure in the chemicals and allied trades in the third quarter of 1958 amounted to £41.1 million, compared with £40.5 million in the same period of 1957. For the first nine months of 1958, capital expenditure by the chemical and allied trades amounted to £123.1 million, slightly below the first nine months for 1957, when the total was £123.4 million.

The following table shows expenditure since 1954:

	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Year
1954 ...	—	—	—	—	97.2
1955 ...	18.4	23.7	24.5	34.5	101.1
1956 ...	29.4	32.8	34.4	44.0	140.6
1957 ...	39.0	43.9	40.5	48.0	171.4
1958 ...	36.9	45.1	41.1	—	—

POTENTIAL VALUE OF RESEARCH ON BIOLOGICAL FIXATION OF NITROGEN

THE contribution made by synthetic fertilisers, great though it was, still represented only a few per cent of the total soil gains. This was stated by Dr. E. R. Roberts, Department of Chemistry, Imperial College of Science and Technology, London, in a paper delivered on 22 January before a meeting of the Fertiliser Society in London.

Since living organisms provided about half the nitrogen that the soil received it was not surprising that interest in the processes involved was re-awakening. Apart from intrinsic scientific interest, the fixation process promised to be of "quite extraordinary technological value" in that it must eventually produce stimulants that would render the maintenance of soil nitrogen and hence productivity both easier and more certain than at the present time. This was especially true if such stimulants could bring down the cost of nitrogenous fertilisers.

During the last 30 years a great deal of information on chemical aspects of biological fixation had been accumulated and Dr. Roberts said he proposed to examine in his paper the more important hypotheses that have arisen and to attempt to evaluate them in so far as they were consistent with all the experimental evidence, bearing in mind that the latter had been obtained entirely from studies on whole cells because rarely had cell-free extracts been observed to fix nitrogen.

There was little doubt that a great deal of the elementary nitrogen fixed by micro-organisms was ultimately converted to ammonia or to amino groups. Until very recently most research had been directed towards the identification of the key intermediate (believed to be ammonia) or the initial product, or the metabolic pathway followed by the nitrogen. At Imperial College, Dr. Roberts said, they had adopted the rather strict physico-chemical approach to develop methods for the quantitative measurement of both inhibition and stimulation of fixation, especially by substances that might reasonably be though to occur in the metabolic pathway of fixation.

Inhibition Studies

Much of the data on which all hypotheses of fixation rested had been obtained from studies of inhibition. In Dr. Roberts' fixation experiments, the substrate had normally been labelled nitrogen gas, and the method used had been to measure fixation rates in the presence of inhibitors. Starting with nitrogen containing 30% of ^{15}N, it was found to be easy to obtain growth constants with an error of $\pm 2\%$ in experiments lasting only a few minutes. Experiments on respiration frequently showed much greater variations.

Dr. Roberts' work hoped to show that an oxidative, or possibly hydrolytic, first step could not be eliminated; he proposed first to consider nitrous oxide in some detail. When it was shown by P. W. Wilson, that nitrous oxide seemed to be a specific inhibitor of fixation, Imperial College workers had studied the gas in great detail. They had found that it was completely reversible, was competitive and specific to fixation. Its affinity for the enzyme was about one-ninth that of nitrogen. Thus it seemed that nitrous oxide was an intermediate in fixation. No evidence was found however that azotobacter could utilise it, or that hyponitrous acid was utilised although this decomposed readily, but slowly into nitrous oxide and water. In spite of the contradictory evidence, therefore, Dr. Roberts and his colleagues had concluded that nitrous oxide was not in fact utilised. That did not prove, however, that it was not an intermediate, since glutanic acid, well established as an intermediate farther along the metabolic path, was not taken up by cells at all readily possibly because of its size. Since the more complex ammonia was readily assimilated in preference to gaseous nitrogen, it was unlikely that nitrous oxide was indeed an intermediate.

Nitrous Oxide as Inhibitor

The question then arose as to how nitrous oxide inhibited fixation. He had suggested that since the molecule was linear, and the distance between its nitrogen atoms was comparable with that in nitrogen, it might be capable of occupying the site at which fixation occurred and competed with nitrogen in that way, for steric interference of this kind might be expected with other molecules of similar shape, interatomic spacing, and electrical properties, e.g., carbon dioxide, hydrogen azide, methyl azide and in cyanate ion, etc.

In the case of carbon dioxide, major experimental difficulties existed since cells produced CO_2 during respiration and unless its partial pressure was kept low, it would inhibit growth. It had proved impossible to obtain data that would enable the investigators to decide anything about the nature of the inhibition produced, whether or not it was competitive, and whether it acted specifically on fixation.

Hydrogen azide proved too strong an acid ($K_a = 10^{-5}$ at 25°) and behaved essentially as the azide ion. Similarly, methyl azide was found to hydrolyse very rapidly in the culture medium and again behaved as azide ion. From examination of its influence on fixation and other cell functions, it proved to be very similar to nitrous oxide, in that it was a reversible, competitive inhibitor and was specific to fixation; it was, however, much more powerful, having comparable effects when present at concentrations about one-hundredth of those of nitrous oxide calculated on the assumption that nitrous oxide had the same solubility in the medium as it had in water. It was stated by Dr. Roberts that there appeared to be fairly close similarity between azide and nitrous oxide.

Cyanate proved to be totally different. Its effect on *A. vinelandii* was irreversible, it was not specific to fixation and it was very much weaker than nitrous oxide. Relatively high concentrations were required to produce immediate inhibition, but much lower concentrations caused inhibition to develop after several hours. Low concentrations of cyanate also produced definite, although small, stimulation of fixation. The differences between cyanate and azide ions, in their effect on fixation, etc., clearly showed that the steric interference postulated to explain the behaviour of nitrous acid was not sufficient. It was also clear that more direct work on nitrous oxide was essential.

The effect of hyponitrous acid, $H_2N_2O_2$, was also considered. It was believed to decompose into water and nitrous oxide and might therefore be expected to behave in a similar manner to the latter. It had been found, however, that it behaved totally differently. It acted as a general poison, having no specific action on fixation, although the latter function was affected in a complex way.

Focus on Hydrazine

Hydrazine had recently attracted more attention than any other proposed intermediate. If fixation were an entirely reductive process, then hydrazine might well occur at a fairly early stage. Dr. Roberts stated that he and his co-workers had found that hydrazine not only inhibited both fixation and respiration, but also that the former was stimulated by low concentrations of hydrazine. Detailed work had shown that far from being rapidly destroyed, hydrazine was preserved by the cells and could be almost completely recovered from the cell-free medium by acid hydrolysis. This unexpected discovery suggested that hydrazine reacted either at the surface of the cells, or with an excreted substance, thereby becoming effectively sequestrated. A search for the sequestering agent had had only negative success.

It had been suggested more recently that hydrazine was an intermediate. Dr. Roberts had observed that hydrazine competed with ammonia, indicating possibly competition for glutamic acid; it might be that it was the latter which was responsible for the sequestration of hydrazine. This work was being actively prosecuted, since it was believed that it would throw fresh light on the fixation problem not merely by explaining the behaviour of hydrazine but also giving a new lead as to the manner in which ammonia inhibits fixation.

The behaviour of hydroxylamine was of interest, partly because it was strongly supported as the key intermediate for many years especially by Virtanen, and partly because it had led to a hypothesis

that although not entirely successful, had much to commend it. It lacked experimental evidence, however, as for instance the occurrence of legmethaemoglobin in legumes and that the same, or a similar pigment had not been demonstrated to occur in the free-living nitrogen fixers. It was accepted, nevertheless, that iron was essential to azotobacter; catalase was known to occur in these bacteria, and its only purpose would seem to be to control hydrogen peroxide. These were the necessary constituents of Fenton's reagent which had been shown to act in certain polymerisation reactions through a medium of small concentration of free hydroxyl radicals. It was therefore inferred that free hydroxyl radicals were available in the bacterial cells and suggested that by reaction with absorbed nitrogen they might be essential factors in fixation.

Ammonia, the "most fashionable key intermediate", was not entirely above criticism. It had often been stated that ammonia was directly assimilated without any period of adaptation, while oxidised forms such as nitrate were only utilised after a lag period. It was further argued that nitrate or nitrite had first to be reduced to ammonia before utilisation could occur. The premises on which these arguments were based were not, however, strictly true. It was found that although small concentrations of ammonia immediately affected fixation, high concentrations inhibited respiration and growth for a time (e.g. 0.1% w/v of ammonium acetate stopped respiration for four hours). More detailed work showed that there was a lag before the uptake of ammonia began, although this was shorter than the same concentration of nitrite. Once adaptation to nitrite had occurred, it enabled uptake of nitrite to continue even when the concentration was abruptly increased by tenfold.

There was some evidence that reduction of nitrate and nitrite to ammonia occurred, but this was inconclusive, and there was no proof that ammonia originated as nitrite, or that the cells did not accept the nitrite preferentially. Using labelled substrates, the distribution of isotopic nitrogen in the amino acid in the cells was the same whether free nitrogen or various nitrogen compounds were supplied. All that could be inferred was that all forms of nitrogen, at some stage in the metabolism, pass through the ammonia form.

Trimethylamine and its oxide had been examined. The free amine could serve as a source of nitrogen, but was not preferred to molecular nitrogen; the oxide was not taken up at all. Both the amine and its oxide inhibited fixation.

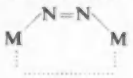
Besides inhibition and utilisation, there were two other factors, namely, ability of some substances to stimulate fixation and the fact that the enzyme hydrogenase seemed to be intimately associated with the fixation process. It was found experimentally that so long as any nitrite remained fixation was inhibited and that it was only after all the nitrite had been used up that the cell fixed nitrogen at rates higher than controls having no nitrite. Results had suggested that utilisation of the nitrite promoted formation of an enzyme system which, while not exercising any nitrogen-fixing ability when dealing with the assimilation of nitrite, exhibited a high capacity for fixation.

The role of hydrogenase had aroused interest. Absence of hydrogenase activity during nitrate assimilation seemed to indicate that the system was fully occupied in the form of nitrate reductase. Its absence during assimilation of ammonia was less easily understood. Extraction of sufficient hydrogenase and concentration had proved difficult. Some recent experiments by the Imperial College group had suggested that iron might not be in the prosthetic group of the enzyme.

The problem had been approached from the viewpoint of certain metal complexes that had the power to transfer hydrogen in certain solutions. It had been postulated that a hydrogenase unit in which the transition metal atom conferred on an adjoining nitrogen or carbon atom the power to function with the metal in the active chemisorption of hydrogen. If two hydrogenase units were spatially situated so that the two metal atoms were capable of chemisorbing nitrogen, then transfer of hydrogen to the nitrogen became possible and reduction was effected.

Later Dr. Roberts suggested that Winfield's hypothesis assumed chemisorption. Among the metals that most readily adsorb or react with nitrogen were iron, molybdenum, and calcium, all of which were essential to the growth of azotobacter. Also, most enzymes isolated in a pure condition had been proteins, many of them metallo-proteins.

Work on the sorption of nitrogen on metallic surfaces suggested that bonds between nitrogen atoms and metal atoms were weaker than bonds between nitrogen and nitrogen, so that



was more probable than

for bimetallic complexes; for quadrimetallic complexes only

was possible. The products of reduction of these complexes might well include hydrazine as well as ammonia or amino groups. Oxidation might well follow a very different course as in general metal-oxygen bonds were stronger than metal-nitrogen bonds.

Desorption products, Dr. Roberts suggested, would be nitrite ion, nitronium ion (NO_2^+) or the dinitrite radical N_2O_4, the first being the most probable.

There were several attractive features of oxidative fixation. Inhibition of fixation by hydrogen could be interpreted as competition for oxygen. Inhibition of fixation involved a step prior to the formation of ammonia, a step that if the interpretation of competition was correct, involved oxidised nitrogen. Inhibition of fixation by nitrite could be due to competition for a hydrogenase (i.e. a nitrite reductase). There was reason to believe that metabolism of nitrate and nitrite might involve metallo-flavoproteins. It might be argued that since nitrite was ultimately reduced to ammonia, stimulation of fixation by nitrite might be merely stimulation of this reductase, which latter would, in the normal course of fixation, regulate the production of ammonia from nitrite. Indirect support for the oxidative reaction involving nitrite could be adduced from the behaviour of trimethylamine and its oxide.

To do justice to the problems involved, said Dr. Roberts, required a relatively large body of researchers. His small group was unable to push forward on a broad enough front at present. It seems reasonable to suppose, however, that the potential technological value of the work discussed in the paper might attact sufficient support from industry to permit that widening of the attack that was required.

Dinner-dance of Ashburton Chemicals

At the dinner-dance of Ashburton Chemical Works Ltd., Manchester, were the directors, l. to r.: B. H. Walker, H. Jones, H. L. Addleshaw (chairman), Dr. L. Meerwein, Dr. F. Buchmeier (managing director), A. Smith and G. A. Tillotson

Analytical Review

VALUE OF SPECTROPHOTOMETRY AND AMPEROMETRIC TITRATION

By
T. S. WEST, Ph.D.

This article reviews three papers which are concerned with: (1) The flame spectrophotometry of cadmium; (2) Spectrophotometry of Mn (III) triethanolamine and Mn III-peroxide complexes; (3) The amperometric titration of potassium.

DETERMINATION of the alkali and alkaline-earth metals by the technique of flame photometry with a simple filter instrument is now a well established procedure. Until quite recently, however, little attention has been paid to the more advanced and precise technique of flame-spectrophotometry, but the construction of new instruments for this purpose and the production of attachments for laboratory spectrophotometers has rapidly altered the situation with the result that considerable attention is now being paid to the determination of elements which are more difficult to excite.

A recent paper on the determination of cadmium is typical of this new interest[1]. The paper reviews previous methods beginning with the classical work of Lundegarth in 1934 which resulted in a detection limit of 200 p.p.m. at 320 mμ with the use of an air-acetylene flame. It then passes on to review wartime Russian work, again mainly with oxygen-acetylene flames, and considers the use of flames from oxygen-coal gas, oxygen-methane, oxygen-hydrogen, air-hydrogen, oxygen-cyanogen and oxygen-acetylene. The air-hydrogen flame has the following advantages: (1) highest sensitivity at 326.1 mμ, (2) lowest background emission, (3) coolest flame when spraying water.

Cadmium Standards

Cadmium standards in chloride and nitrate solution are used. These show a difference in sensitivity in the high concentration regions (about 2.5% at 2,300 p.p.m.), but agree within 0.3% at 600 p.p.m. and better still at lower concentrations. The choice of standard is purely arbitrary and is of little consequence since the method of extrapolation to infinite dilution is used. This method minimises interferences which arise from the presence of co-solutes. Corrections are made for background interference by taking readings on either side of the line, instead of using 'blank' solutions. Aluminium has a quenching effect on the cadmium flame which is proportional to concentration up to 300 p.p.m. of Al^{3+}, beyond which the effect is less marked. Copper interferes only slightly, but it shows lines at 324.8 mμ and 327.4mμ each 1.3mμ on either side of the cadmium line. Consequently when copper is present, the slit-width has to be controlled rather carefully. Calcium has a slight quenching effect, but iron has none though it produces some background radiation.

In an oxygen-hydrogen flame aluminium shows little radiation interference with the cadmium determination, but it causes considerable background interference which reduces precision considerably at low cadmium concentrations. Aluminium itself is determined without interference from cadmium by intensity measurements at 485 mμ (peak) and 478 mμ (off peak). The accuracy of the cadmium method is such that the probable error on an averaged result can be kept at 0.1 p.p.m. below a concentration of 100 p.p.m. of cadmium. The detection limit is 0.5 p.p.m. In these experiments the optical equipment was a Beckman D.U. spectrophotometer with photo-tube multiplier.

Spectrophotometry of Mn (III) complexes of Triethanolamine and Peroxide. Polarographers and users of EDTA are familiar with the complex formed between manganese (III) and triethanolamine. An interesting application of this chelate formation to the spectrophotometry of manganese has now been described and is well worth examination. Manganese (II) forms a tan-coloured precipitate with triethanolamine above pH 5.5. However, the solution absorbs oxygen to form the green-coloured manganese (III) complex. This new work[2] shows that the oxidation is very slow and tends to be incomplete when more than 0.5 millimole of manganese is involved and furthermore the absorption changes with time in a manner which is characteristic of the presence of a second coloured species. The manganese (III) complex was not formed quantitatively till 24 hours had elapsed.

When peroxide was added to speed up the oxidation a red colour was formed which was found to be due to a manganese (III)-peroxide complex, not a higher oxidation state of manganese. The red complex is unstable and decomposes rapidly on boiling with liberation of oxygen and manganese (II). Consequently attempts to speed up the formation of the manganese (III) triethanolamine complex by this procedure were unsuccessful since some manganese (II) is always produced when the initially formed peroxide complex breaks down.

Air (oxygen) at the boiling point of the solution was finally recommended for oxidation after a wide range of oxidants had been examined. Bromate is added to promote decomposition of the hydroperoxide and the solution is finally treated with sodium sulphite which removes the excess oxygen and decomposes any remaining hydroperoxide without affecting the manganese (III) triethanolamine complex.

At 438 mμ the molar absorbance index of the manganese (III) triethanolamine complex is 199. The molar absorbance indices of the Co (II) and Ni chelates of triethanolamine at 438 mμ are 16 and 25 respectively. Thus they show a positive interference which is not serious at low concentrations. On the other hand chromium has a molar absorbance index of 110 and must therefore be separated. Silver and titanium (III) form precipitates in the alkaline solution which must be removed by filtration. None of the 16 other ions examined gives rise to interference. On the whole this procedure appears to be rapid and rather selective. The accuracy of the method is ±0.5%.

Amperometric Method for Potassium? Polarography of potassium is a subject that receives scant attention from analytical chemists for reasons which are well known. Moreover, the technique of flame photometry has proved attractive and the relatively new reagent sodium tetraphenylboron has provided reliable and rapid procedures for the gravimetric and titrimetric determination of potassium. Polarographers will no doubt find a new amperometric method for potassium, based on the use of this reagent of considerable interest.

Direct titrimetric methods based on tetraphenylboron which have been devised so far depend on conductometric titration at low- and high-frequency and on potentiometry. The conductometric procedures are unsatisfactory in the presence of appreciable concentrations of electrolyte and the potentiometric end-point is said to be somewhat poorly defined. Amos and Sympson[3] now report that the tetraphenylboron reagent gives an anodic wave and consequently an anodically polarised dropping mercury electrode acts as an indicator for the titration of potassium with this reagent. The lowest concentration of potassium which can be titrated is 2×10^{-3}M; the upper limit is 2×10^{-2}M.

Ions which reduce at + 0.08 v interfere and, of course, those which precipitate with the reagent; the halides also interfere more or less seriously. Although this method is an interesting one from a theoretical point of view, the practical worker may be excused a lively sense of amusement when he reads in the concluding paragraph that a titration requires 2 to 3 hours. Procedures such as these ridicule the purpose of the journal that bears such a proud title.

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HIGH-PURITY AROMATICS FROM COKE-OVEN OIL

HIGH-purity aromatics from crude coke-oven light oils have been successfully produced at Jones and Laughlin Steel Corporation's $2 million hydrofining-Udex extraction plant at Aliquippa, Pennsylvania. In operation since August 1957, the plant has a capacity of 55,000 gall./day of BTX (about 70% benzene, 20% toluene and 10% mixed xylenes). Light oil from three of the company's plants, produced during high-temperature carbonisation of coal to make metallurgical coke and recovered from coke-oven gas by scrubbing with an absorbent oil, is used as source material after being stripped of carbon disulphide and other light ends.

To boost yield and quality of the benzene, toluene and xylene, Esso's hydrofining process for desulphurisation and hydrogenation and Universal Oil Products Udex extraction for separation of aromatics has been adopted. (*Chemical Engineering*, 1959, **66**, No. 1, 110.)

After pretreatment, light oil is heated and fed to the Hydrofiner reactor. Pure hydrogen is used to selectively hydrogenate unsaturated hydrocarbons and sulphur compounds, with hydrogenating BXT products. After caustic scrubbing, BXT products are separated from gases and hydrogen is recycled to the reactor. Residual hydrogen sulphide is removed in a steam stripper.

The Udex process extracts aromatics from paraffins using aqueous diethylene glycol, then removes pure aromatics from the glycol. Hydrofined light-oil feed to the Udex unit contains 95 to 98% aromatics (c.f. petroleum catalytic reformate contains 25 to 55% aromatics).

In the Jones and Laughlin unit coke-oven light oil enters the 90 ft.-high extractor at about the mid-point and is contacted counter-currently (liquid-liquid contact plates) with glycol, which enters from the top. Glycol selectively absorbs aromatics and removes them from the bottom of the column in a rich solvent stream. The raffinate overhead stream (paraffins, some xylenes and glycol) pass to a water-wash tower where diethylene glycol is recovered. The aromatics stream enters the stripper (about 130 ft. high) and separates into three streams—centre, aromatics plus water; lean-solvent bottoms; and an overhead paraffins plus water.

Aromatics from the centre stream enter the water-wash tower where remaining traces of glycol are removed, and are then pumped to a day-treatment tower. Final fractionation is carried out in three towers; two continuous towers for benzene and toluene, plus a batch column for xylenes. Control systems ensure purity of both benzene and toluene (0.1 mole % impurity in the benzene).

Columns, it is reported, are equipped with pressure compensated temperature-controlled, reflux systems, the temperature control point being located at the optimum section of the column. Good controllability for specification products is ensured by a combination of temperature control and slightly increased reboiler duty.

Some important factors in the Udex section are stressed. Thus extraction and stripper operate nearly isothermally, with relatively little temperature difference between hottest and coldest plants, so sharply reducing cooling and reheating of large-volume solvent streams. Overhead from the stripper (containing paraffins of low boiling point) serves as extractor reflux, displacing high-boiling paraffins in the rich aromatic bottoms. Water is separated from the overhead stream and the central stream in the settling tanks, then recycled to the bottom of the stripper. This is stated to adjust the glycol composition of stripper bottoms for recycle to extractor.

U.S. Work on Use of Diborane in General Addition Reaction

ACCORDING to studies by Herbert C. Brown and George Zweifel of Purdue University, U.S. (*J. American Chemical Society*, 5 January 1959) treatment of an olefin with diborane followed by oxidation of the resulting alkylborane with hydrogen peroxide, results in a general addition reaction. Also the method can be used to rearrange and isomerise an unsaturated molecule.

Using diborane, the addition to the double bond is always *cis*. Yields are quoted as being 80% to 90% and the product 97% to 98% pure *cis* hydrated isomer. With terminal olefins primary alcohols results at room temperature or lower. With internal olefins, primary or internal alcohols are produced. With an internal double bond, heating the reaction mixture at 160°C for one hour followed by oxydation with hydrogen peroxide, a primary alcohol results.

The reaction is stated to be complete in minutes, even at 0°C. According to Brown and Zweifel, the boron in the intermediate alkyl borane "walks down to the end of the chain" and is then in a position to be oxidised to a primary alcohol. No special equipment is required and reaction conditions are mild.

No hazard is presented in working with diborane since it is generated by reacting sodium borohydride with boron trifluoride in an ether (e.g., diglyme or tetrahydrofuran) and passed directly into the reaction vessel. About 30 lb. of a C_{10} alcohol can be produced with 1 lb. of diborane.

Precautions in Using C.S.I.R.O.'s Mansfield Process For Evaporation

ALTHOUGH C.S.I.R.O.'s Mansfield process is now being widely used throughout Australia to curtail evaporation on small water-storages, in some cases results have been marred by causes that can be avoided. The Mansfield process involves the use of a thin film of hexadecanol (a pure form of cetyl alcohol) to reduce evaporation. The film is maintained by beads of SI-RO-SEAL hexadecanol contained in a raft floating in the water.

Breakdown in the materials of rafts and faults in their design have been responsible for most of the difficulties met in using the process, it is stated. Individual rafts have failed by sinking —due to cracking of float chambers, buckling so that the gauze windows are not properly immersed, breaking the above windows so that hexadecanol has been lost, or by silting up with dust and mud.

The rafts, C.S.I.R.O. stress, should be 3 ft. square with gauze windows having a combined total length of 6 ft. at water level. Materials of construction should be chosen to avoid corrosion, i.e., brass, bronze or copper are preferred to aluminium which is attacked by brackish water. Regular inspection of rafts is necessary to ensure that the gauze is clean, the charge of hexadecanol is sufficient, etc. Cost of a raft is about £18 and a satisfactory one should last for about three years. About £4 per year should be allowed for the hexadecanol for a dam one acre in area. Yearly cost of treatment, apart from labour, is stated to be about £10. Where infestation by algae is present copper salts are required.

Separating C_2 and C_3 Gases by Mixed Packing

WHILE gas chromatographic methods have been designed to separate C_2 and C_3 gases and also the olefins from the saturated compounds, a simple method for the resolution of ethane, ethylene, propane and propylene has not previously been reported. Olefins can be separated cleanly from saturated hydrocarbons on a column packing consisting of a saturated solution of silver nitrate in ethylene glycol supported on graded Celite. C_2 gases are separated from the C_3 by a tri-*iso*-butylene/Celite column.

J. A. Barnard and H. W. D. Hughes of the Department of Chemical Engineering, University College, London W.C.1, report (*Nature*, 1959, **183**, 250) that they have mixed the above mentioned packings together mechanically and on a W-shaped column, 4 m. long by 6 m.m. internal diameter, separation of all four gases was readily effected at room temperature. Carrier gas was 0.4 l./hr. nitrogen; inlet pressure, 758 m.m.; outlet pressure, 712 mm.; column and katharometer temperature, 25°C.

Further work, these workers report, has shown that it is also quite possible to separate iso-butane from the four gases previously mentioned on the same column.

Overseas News

D.C.L. WILL HAVE INTEREST IN NEW AUSTRALIAN PETROCHEMICAL PROJECT

THREE U.S. concerns and one Australian company, in which the Distillers Co. Ltd. of London are interested, are to build four petrochemical plants at Altona, a suburb of Melbourne. The total cost will be £A23 million (£18.4 million).

A plant to make styrene for the synthetic rubber and plastics industry will be built by a new company formed by Dow Chemical, U.S., and C.S.R. Chemicals Pty. The Distillers Co. hold a 40% interest in C.S.R. Chemicals.

The Vacuum Oil Co. Pty., a subsidiary of Standard-Vacuum Oil, New York, will build and operate the key unit of the whole project, producing ethylene and butadiene. Union Carbide Australia, affiliated with Union Carbide, New York, will set up a plant to make polythene from ethylene produced by Vacuum.

Styrene and butadiene will be used to make GRS-synthetic rubber in a fourth plant of the petrochemicals group. Australian tyre manufacturers will be invited to participate in this unit. Output of synthetic rubber a maximum of 30,000 tons, will it is expected be sufficient to meet Australia's needs until 1965 at least, when estimated consumption will be 80,000 tons a year.

The project will give Australia its first large-scale petrochemical industry and is expected to have an output of £A11 million worth of products annually, saving several million pounds a year in imports. It has been under negotiation for more than 15 months. Construction is to start almost at once and the plants are expected to be in production by mid-1961.

Montecatini Urea Process For Sunolin's New Plant

A contract has been signed in New York whereby Sunolin Chemical Co. (Wilmington, Delaware) of the Sun Oil Group will utilise a Montecatini process at their new urea plant to be built at North Claymont, Delaware. The new plant, capable of producing about 200 tons of urea a day, will be designed and built by M. W. Kellogg of New York in co-operation with Montecatini technicians. It will be the fourth urea plant utilising Montecatini's process in the U.S., and the twenty-eighth in the world.

American Finance for French Pharmaceutical Expansion

Credit of 85 million francs has been granted by the Washington Export-Import Bank to the Union Chimique Atlantique, Paris, an affiliate of the Upjohn Company, Kalamazoo, Mich., for the expansion of plant for the manufacture of pharmaceutical chemicals. The French subsidiary of Abbott Laboratories of Chicago, Abbott, S.A., St. Remy, has been granted by the same bank a credit totalling F.95 million, for the expansion and modernisation of plant for the manufacturers of pharmaceuticals and fine chemicals.

Canadian Firm Plans Bigger Output of Chlorine

Western Chemicals plan to increase their output of caustic soda and chlorine from their plant at Duvernay, Alberta, by 50%. Under a new programme on which $1½ million will be spent, daily production will be about 65 tons of caustic soda and 60 tons of chlorine.

Rumania Steps Up Plastics Production

A polyvinyl chloride section is to be commissioned this year at the Turdu chemical plant in Rumania. It will have a capacity of 5,500 tons a year. At the Faragas chemical combine in the same country there is to be a phenol section for manufacturing synthetic fibres, with an annual capacity of 3,000 tons. Output of plastics and synthetic resins in Rumania is to go up from 2,000 tons last year to 6,300 tons this year.

Germans Building Fertiliser Plant in Korea

Some 100 engineers and technicians from West German companies are expected at Seoul, capital of South Korea, to begin introductory work on the erection of a synthetic fertiliser plant there. The plant, which is to cost an estimated 23½ million dollars, is being built by a consortium of five West German firms, with the Lurgi concern playing the most important role. Work on the plant is to start in March of this year and building is expected to take about two and a half years. Annual capacity of the plant will be 85,000 metric tons.

Industrial Solvents Refining Plants Starts up in Santiago

An industrial solvents refining plant will begin operations this month at the Concón petroleum refinery, built and operated by the Empresa Nacional del Petróleo (ENAP), which is a state-owned enterprise charged with development and production of petroleum products.

The expansion programme at the Concón refinery is under the supervision of the W. M. Kellog Co., which also built the original refinery. Chilean engineers and technicians, however, have carried out all layout and construction work.

According to information supplied by ENAP, daily capacity for the new plant will be of 54.5m³ of different types of solvent naphtha, plus 60m³ of white gasoline, and 55m³ of turpentine.

Total investment for the new plant will reach $250,000. It is estimated that the plant's production will satisfy the country's requirements until 1969. An estimated $700,000 in foreign exchange will be saved yearly.

Fertiliser Project for Peru

A Japanese group is stated to be interested in the installation of a plant in Chimbote (Peru) for the manufacture of fertilisers from refinery by-products. The cost of the plant, which would have an initial annual output of about 40,000 tons of ammonium sulphate and 20,000 tons of urea, is estimated at $16.6 million.

Soviet Sulphuric Acid Production

The annual report of the Soviet Central Statistics Board reports that last year production of sulphuric acid was 4.8 million tons, an increase of 5% on 1957.

East German Production of Plasticisers Up

Statistics just released by the East German government show that, in 1957, the production of plasticisers stood at 23,193 tonnes. This total was 1,462 tonnes, or 6.7%, up on figures for the previous year. Exports, including those to West Germany, rose by 1,127 tonnes (23.1%) to 6,228 tonnes.

East Germany's polystyrene production during 1957 is given as 3,329 tonnes, 689 tonnes or 26.1% higher than the 1956 total. Exports rose by 116 tonnes (22.1%) to 627 tonnes.

New Method of Producing Sulphite Cellulose

Research at the Institute of Wood Chemistry at the Norwegian College of Technology in Trondheim has led to the development of a new method for producing sulphite cellulose from wood.

It is reported that the new technique will lead to a considerably more efficient use of the wood. Results obtained indicate that 60 to 62% of the wood is utilised for cellulose production. This compares with the normal rate of 50%.

Development work is being continued on the process so that it can be applied to commercial production.

Hercules Plan Commercial-scale Plant for Penton

Following general market acceptance of Penton, a chlorinated polyether, produced for the last two years in develop-

ment quantities, Hercules Powder Co. now plan a commercial-scale plant.

Chemically Penton is based on pentaerythritol. The latter undergoes hydrochlorination, then ring closure via removal of water from the β molecule. The resultant cyclic ether, bis-3,3'-chloromethyl oxytane, is polymerised to Penton. This plastics material has been found to possess notable mechanical, electrical and chemical properties. Due to its outstanding resistance to chemicals, Penton is used for valves, fittings and coatings in anticorrosion equipment. It can be moulded in conventional injection and extrusion equipment.

Cost of pentaerythritol and the complex processing required will keep Penton in the speciality price range, Hercules admit, but volume production is expected to help in reducing the present price of $6/lb. Estimated price is put at $1.25/lb. (similar to that of nylon moulding powder).

By-products from Rourkela Steelworks and Coking Plant

Last month the West German-financed steelworks and coking plant of Rourkela was opened 280 miles west of Calcutta. With a throughput of 1,600,000 tons of home-produced coal annually, the plant will have a capacity of 1,680,000 cu. m. of coke-oven gas daily; it will also produce as by-products commercial quantities of tar, ammonia, benzene and sulphur. On the same premises plants are to come into operation for the working-up of these by-products. A tar distillation plant will produce street tar, coal-tar oil, moulded goods from naphthalene, also solid anthracene and asphalt granulate. Pressure refining of the crude benzole with redistillation will be carried out in a special plant, and processing of the hydrogen sulphide washed from the gas with sulphuric acid.

Calcium Carbide Plant Operating In Israel

Now in operation in Petah-Tikvah, near Tel-Aviv is a calcium carbide plant with a capacity of 10,000 tons annually. This new plant will meet Israel's needs for calcium carbide, previously imported. Export outlets will have to be found for about two-thirds of the production. The plant is that of Meyer Chemical Industries Ltd.

Greece Seeks To Make Best Use Of Lignite

The Greek Government has announced that it is to invite a United States expert to Greece to give his opinion on the best use to which by-products of Greek lignite could be put in the manufacture of chemicals.

Italy's Three Tetraethyl Lead Plants

Three plants in Italy produce tetraethyl lead; one at Fidenza (Compagnia Italiana Petrolio), another at Bussi (Montecatini) and the third at Trent (Societa' Lavorazioni Organiche e Inorganiche). Total capacity of these plants is about 10,000 metric tons a year and, at present, production is about 6,000 tons a year.

Practically the whole of this output is accounted for by the bromide-chloride type with 61.5% content of tetra-ethyl lead. A small quantity (slightly over 1,000 tons a year) is imported and an even smaller amount (about 200 tons) is exported.

Adverse Balance Sheet of Sicilian Sulphur Industry

Silican firms engaged in the sulphur industry are in debt to the extent of nearly 20,000 million lire (about £11.4 million). Out of this total, 13,000 million are owed to the Bank of Sicily and 4,500 million to Ente Zolfi Italiani (Italian Sulphur Board).

Against this, the value of sulphur produced (about 6,000 million lire) is to be written on the credit side. This makes a deficit of about 14,000 million lire. The industry has absorbed about 6,000 million lire in non-reimbursable and local grants.

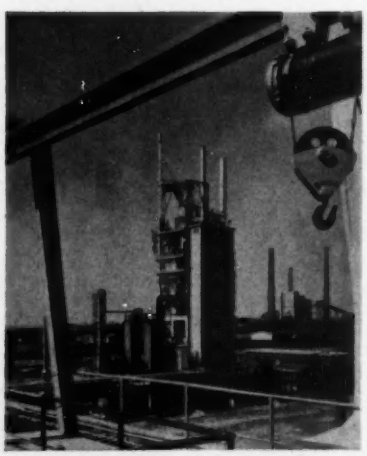
E.N.I. Investments in New Italian Petrochemicals Plant

The State-controlled Ente Nazionale Idrocarbure (E.N.I.) are reported as launching a new 60,000 million lire (about £30 million) loan, termed 'E.N.I.-South' The loan is to be divided into three equal parts, the first to be subscribed shortly. It is understood that a large part of this loan will be utilised for the construction of a petrochemicals plant at Gela, Sicily, and of another at Stanic Refinery at Bari in which E.N.I. hold a 50% interest. The latter plant will require an investment of some 27,000 million lire, it is reported.

Erdölchemie's First Olefin Unit Now in Operation at Dormagen

SECOND stage of the gaseous olefin unit at the Dormagen-on-Rhine facilities of the Erdölchemie GmbH concern, subsidiary of the German B.P. company and Farbenfabriken Bayer AG., will, when brought into full operation in the near future, manufacture two-thirds of the total olefin production planned. The first stage of the plant, which came into operation at Dormagen late last year, produces one-third of the olefin capacity.

With large-scale olefin processing, the company will enter into commercial production of ethylene and propylene for chemical intermediate and end products and later start work with C_4 olefins, bringing Erdölchemie into the field of synthetic rubber manufacture from mineral oil sources. Other future plans for the concern, which will start full-scale operations of its first-stage installation in summer of this year, concern the chemical processing of gases produced by the pyrolysis of liquid hydrocarbons in the olefin field.



View of the benzene-cracking and gas extraction plant at the petrochemical plant under construction at Dormagen-on-Rhine, West Germany, by Erdölchemie G.m.b.H., a joint subsidiary of Bayer and B.P. Benzin und Petroleum. Being built in the centre is the cracking tower

The olefins—ethylene, propylene and butylene—will be produced at Dormagen in a benzene-cracking plant with an annual throughput of about 260,000 tonnes, the benzene to be supplied by the new B.P. refinery at Dinslaken when it opens in just under two years; until then supplies will be shipped from other northern European refineries of the company. In the same cracking plant high-quality motor spirit, fuel gas and fuel oil will be manufactured.

Dormagen's first plant consists of a Lurgi cracking unit with an annual throughput of 65,000 tonnes of benzene. The cracking gases formed in this plant are divided off by the Linde separation process, in which temperatures of as low as minus 150°C are used. Up to now Erdölchemie have reported simply that one of the plants was opened in September 1958, while giving no further details.

A certain percentage of the ethylene produced at the petrochemical plant is to be processed into ethylene oxide by the process of the Scientific Design Co. Inc., New York.

Production installations will be largely automatic. At the end of the primary stage of construction there will be some 600 employees only with an investment per job carried out of between DM 400,000 and DM 500,000 (between £33,340 and £41,670) by the company.

Lying directly on the Rhine, the plant will have an extensive loading quay for ships, which will take on finished products for transportation as well as bringing raw materials to the plant.

EQUIPMENT REVIEW

Electronic Control Instruments: Pumps and Compressors: Safety Devices

CHEMICALLY RESISTANT GOGGLES CHEMICALLY - resistant materials make the Fleming goggle No. 0080 particularly suitable for places where chemicals are used. The lens is made of Cobex rigid polyvinyl chloride and the surround from flexible polyvinyl chloride. A patented system of ventilation provides protection against liquids and other harmful particles. The goggles can be worn over prescription spectacles and two independent flaps at the bridge, which can be trimmed to the size needed by the wearer, close the gap at the sides of the nose. The Celtone spectacle No. 3035 by the same makers. **Fleming Safety Equipment,** 146 Clerkenwell Road, London E.C.1, is particularly suitable for visitors' use. These and other spectacles can be cleaned with the Fleming lens cleaning and de-misting cabinet No. 0063, which dispenses a liquid in a fine spray and supplies tissues with space for their disposal after use.

ELECTRONIC-PNEUMATIC LEVEL CONTROLLER LEVELS of solids or liquids at high temperatures, high pressures or under corrosive conditions can be controlled with the Pneutronic on/off level controller manufactured by **Fielden Electronics Ltd.,** Wythenshawe, Manchester. This provides an output air pressure suitable for operating a standard pneumatic diaphragm control valve. A robust electrode is the only item in the container. The equipment is fully transistorised and operates from a supply of 12 volts d.c.

The controller can be used for the pneumatic control of powdered or granular solids, and any liquid. Electrodes to suit a particular application can be supplied (i.e. for high temperature, high pressures or corrosive conditions).

PRECISION MEASURING RELAY LELAND Leroux Sensitact precision measuring relays, developed by Brion Leroux et Cie of Paris and based on their patented spring suspension moving coil unit, are now available through **Leland Instruments Ltd.,** 22-23 Millbank, London S.W.1. The relay consist of a galvanometer movement, complete with scale and pointer, to which has been added a moving contact. On each side of this are arranged two fully adjustable contacts which are instantly accessible beneath a transparent plastics dust cover and are adjustable over the full range of the scale. The relays are fully shielded and are available in 16 models, with moving coil resistances ranging from 2.5 ohms to 7,500 ohms and with full scale deflection current ratings from 10 mA down to 0.02 mA.

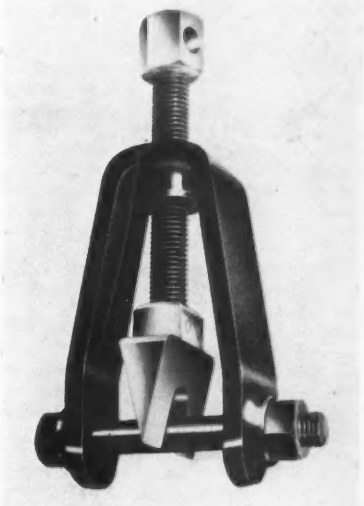
HIGH VACUUM PUMPS A RANGE of high vacuum pumps suitable for use under laboratory conditions is now in production by **Genevac Ltd.,** Radcliffe, Lancs, a new subsidiary of General Engineering Co. (Radcliffe) Ltd. Qualities claimed for these pumps include reliability and consistency of performance, freedom from vibration, silent running and an exceptionally low ultimate. The single-stage high-vacuum rotary piston pump is in 2, 4, 8 and 12 cu. ft./min. capacity with an ultimate vacuum of less than 0.005 m/m. Hg. The double-stage model is in 2, 4 and 6 cu. ft./min. capacity with an ultimate vacuum of less than 0.0002 m/m. Hg. The design permits higher pumping speeds at 100 microns and the pressure rise is less than 0.5 m/m. Hg with maximum ballast.

EXPANSION UNIT IN PLASTICS AN improved and modified expansion unit being marketed by **Barflo Ltd.,** 56 Cavendish Place, Eastbourne, Sussex, is made in a variety of plastics to suit the nature of the installation and the type of pipe to be installed. The telescopic action on expansion or contraction is sealed against weeping by the Polysar 'O' rings and two packing glands. Packing glands can be renewed after prolonged wear without interfering with the pipe service.

STATIONARY HYDROVANE AIR COMPRESSORS ADDITIONS to the range of Hydrovane air compressors manufactured by **Alfred Bullows and Sons Ltd.,** Long Street, Walsall, include the 200SR9501, with an output of 95 c.f.m. at 100 p.s.i. It is mounted on a 6 ft. by 2 ft. horizontal air receiver. A water-cooled oil cooler is fitted as standard and the water flow is controlled thermostatically. An air-cooled oil cooler can be supplied. The 250SR12001 has an output of 120 c.f.m. at 100 p.s.i.

PROCESS RESPONSE ANALYSER IT is claimed for the new process response analyser type JY.743 of the **Solartron Electronic Group Ltd.,** Thames Ditton, Surrey, that for the first time it enables precise measurements to be made on control systems such as are required for chemical plant, nuclear reactor heat exchangers and many other industrial uses. This is a development from the Solartron transfer function analyser and is for very much slower systems from one cycle in three hours to 100 cycles a second. This range will cover most normal industrial processes employing automatic close-loop servo systems. It provides the necessary design information for new control systems and also enables them to be proved before the production stage is reached. It also enables all servo and control systems to be tested regularly without halting production. The requisite information is given by plotting phase/amplitude response (Nyquist) diagrams with high accuracy over the entire range of frequencies to which the system will respond. The instrument will operate direct from transducer signals.

FLANGE SPREADING TOOL ORIGINALLY designed for breaking bolted flanged joints on oil pipelines, the flange spreader made by the **Borer Engineering Company,** 54 Park Lane, Croydon, Surrey, is used by many industries, including chemical works. It is claimed that it does the work quickly, safely and without fear of damage. It is operated by removing all nuts and bolts, inserting the pin of the spreader in the bolt hold and inserting the wedge between the flanges by tightening the drive screw. An alternative design fitted with blunt wedges, for use on ring-joint flanges, is also available.



Flange spreading tool

METAL WASHING MACHINE ALTHOUGH it has only one chamber, it is claimed for the Wache metal washing and processing machine that it does the work of a plant of two or three chambers. The U.K. agents are **I.F.A. Engineering Co. Ltd.,** 13-17 Rathbone Street, London W.1. The machine uses the spray method and is suitable for pickling, degreasing and phosphating all metal components.

The sequence of operations is automatically controlled. Heating can be by steam, hot water, electricity or gas. There are three sizes, with capacities of 132, 165 and 185 gall. The height in each case is 24 in. and other measurements vary from 36 by 24 in. to 48 by 32 in. Two or three thermometers, each with a range of 0 to 120°C are fitted to the machine to check and control the temperature of both the treatment solution and the hot water for the rinse.

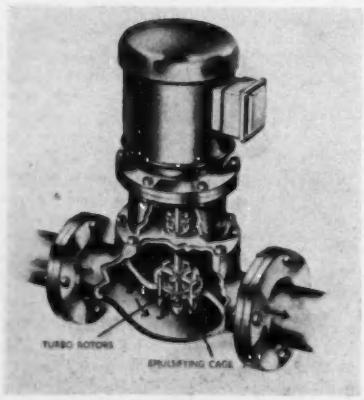
HEAVY-DUTY FACE-SHIELD FEATURES of the Supervizor 500 heavy-duty face-shield made by **Safety Products Ltd.**, Holmethorpe Avenue, Redhill, Surrey, include a broad and deep fibre brow-guard extending well over the head. A worm gear adjustable headband enables the size to be altered by a flick of the finger and keyhole slotting on the vizors prevents dislodgment. All types of prescription spectacles or goggles may be worn with the face-shield without discomfort.

PIPE-LINE EQUIPMENT FLUIDS are mixed as they flow through a pipeline, making large agitating vessels unnecessary, with the Thrumix continuous pipe-line mixer, manufactured by **Wm. Boulton Ltd.**, Providence Engineering Works, Burslem. It is made in a range of sizes from 1 in. to 6 in. bore and can be inserted into a pipeline without bends or tees. The principle employed is a very high degree shear and an easily obtained controllable degree of recirculation. The motor ranges from ¼ to 2 h.p. according to requirements. Either a standard stuffing box or mechanical seal is fitted as required. Throughput varies from 14 gall. a minute for low viscosity materials to 400 gall. on high viscosities.

Applications of the mixer suggested by the manufacturer are: combining liquids; liquids and gases, aeration of liquids and gas absorption; mixing flocculation agents; sludge conditioning.

Two models are available. The first has a fixed degree of recirculation and the second, with means for axial movement allows varying degrees of recirculation and controlled shear.

Cost of the units ranges from £60 to £140.



Thrumix continuous pipeline mixer

HIGH-SPEED SIEVING EQUIPMENT POWDERS at 10 tons an hour and liquids at up to 12,000 gall. an hour can be screened using the Invicta sieving and straining machine manufactured by **Russell Constructions Ltd.**, Russell House, Adam Street, London W.C.2. It measures 3 ft. across the sieve by 2 ft. and runs at 3,000 r.p.m. Parts are interchangeable and cleaning and maintenance are stated to be easy.

Russell Invicta sieving and straining machine

PACKAGED CONTINUOUS DRIER A SMALL self-contained drying unit suitable for processing a wide range of materials in the form of powders, filter cakes, granules, etc., has been produced by **Dunford and Elliott Process Engineering Ltd.**, Linford Street, London S.W.8, as a packaged version of their rotary louvre continuous drier. This new model is a compact and versatile unit which can be used for carrying out tests as a preliminary to full scale processing or for the rapid and continuous handling of small quantities of materials. Besides drying it is capable of roasting and cooling heating arrangements.

The package drier has a holding capacity of approximately 1 cu. ft. of material maximum, and the drying time may be varied between 5 and 60 minutes to suit the moisture content and the type of material to be processed. Under favourable conditions the unit is capable of evaporating 100 lb. of free water per hour, while based on the above holding capacity and drying times it will handle between 1 and 12 cu. ft. of material per hour. A Tubix high-efficiency dust collector is attached to the exhaust hood and fitted instruments include an air flow measurement device and temperature indicators for both inlet and exhaust.

As the rotary louvre drum revolves at slow speed the whole bed of material is turned over gently while maintaining its angle of repose, the particles moving gradually from the bottom to the top of the bed. The material travels slowly towards the discharge end with a spiral motion in a compact mass maintaining a constant position in respect of the louvres and channels through which the hot air is admitted. Exhaust products are carried upward throughout the length of the drum through the vaned discharger and into the exhaust hood. At no stage in the process does the material drop freely through a current of air and thus the amount of fines which pass out with the exhaust gases is practically negligible. Friable substances are not broken and as there is practically no differential movement between the louvres and the material, polished substances such as crystals emerge unscratched after processing.

All the parts of the drum which come in contact with the material are made of stainless steel and the life of these parts is very long owing to the complete absence of abrasion. Maintenance costs are therefore reduced to a minimum.

The following moisture reductions have been achieved with inlet temperatures ranging from 120°C to 300°C which is varied to suit the materials being handled:—

Cellulose acetate	72.9% to 2.0%
Dicalcium phosphate	5.0% to 0%
Polystyrene	20.8% to 1.42%
Sulphate of ammonia	2.5% to 0.1%

With aspirin a moisture reduction of 5% to 0.1% has been achieved with an inlet temperature of 50°C.

NEW V-NOTCH CHLORINATORS AMONG new equipment by **Wallace and Tiernan Ltd.**, Power Road, London W.4, are V-notch chlorinators which have been designed for maximum adaptability based on a wide range of gas flow. Extreme flexibility plus the accuracy to which the feed rate may be held are features of the control system, the basic component of which is the V-notch variable orifice.

A manual control knob actuates a rack and pinion device for raising and lowering a cylindrical plug. The plug has a V-shaped groove machined parallel with the axis starting near the lower end and cutting deeper as it approaches the further end. As the plug moves up and down inside a fixed ring the V-shaped orifice area is thus varied in a simple but positive fashion, speedily adjusting the flow of gas. The precision of this method provides the operator with the means of securing reproducibility of readings on a feed rate indicator to carry out a programme. Additional devices allow this to be performed automatically and, if necessary, in conjunction with other apparatus.

The problem of handling certain 'hard-to-feed' materials, such as zinc oxide and diatomaceous earth led to the development of the Wallace and Tierman dry chemical feeder. Volumetric in principle, it will feed solid free-flowing chemicals in powder or granular form with

accuracy. Arching, clogging or flooding of the material is prevented. The feed rate is adjustable over a wide range by a simple control knob.

THERMOSTAT CONTROLS VENTILATION

An additional control taking over in hot weather to operate the fans when the heating plant is shut down is a feature of a thermostat specially suitable for factories using unit heaters and forced air convector for basic heating. The makers are **Honeywell Controls Ltd.,** Ruislip Road East, Greenford, Middlesex. A unit heater installation can be controlled entirely from the thermostat, enabling the operator to run the equipment automatically as with a conventional thermostat or continuously regardless of temperature factors. It also allows him to stop the fans completely when the space will be unoccupied for considerable periods. The heavy loading allows appliances to be installed which will heat the room much faster initially without the added expense of a double pole switch and means that the control can be situated in the room instead of near the mains switch and meter. The new features of the thermostat are based on a three-position manual control with a locking device. The three positions are: automatic, which brings the conventional function of the thermostat into operation; on, which allows the fans of unit heaters to turn even when the thermostat is not calling for heat, and the off position, which shuts the plant down completely.

POLYTHENE VATS FOR CHEMICALS

Probably two of the largest moulded polythene vats produced in Europe have been manufactured by **Metal Containers Ltd.,** 17 Waterloo Place, London S.W.1, for the chemical industry at considerably less cost than the conventional types of protected vessels.

The two vats have a circumference on the outside lip of almost 13 ft. and an overall height of 4 ft., giving a nominal capacity of 250 gall. These vessels can be manufactureed to the customers' individual requirements and specification in either cylindrical or rectangular form and may have fittings such as threaded bosses for draw-off taps included in the moulding.

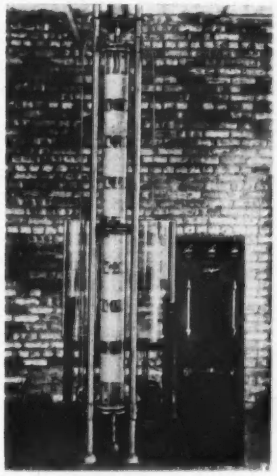
The company are also offering a range of standard cylindrical vats with nominal capacities of 50, 100, 150, 200 and 250 gall.

Manufactured in one piece, without joints, from high pressure polythene, these vessels are suitable for a wide range of materials including sensitive chemicals and highly corrosive acids.

COLUMN EXTRACTION PLANT

The Spiradyne column extraction plant is tailor-made to customers' requirements, with a choice of either manual or automatic controls, by the **Podbielniak Inc.,** Dept. S., 341 East Ohio Street, Chicago 11, U.S. This equipment is designed to meet the need for a low-cost, small capacity plant intended for pilot plant investigations or small scale production. It is especially applicable for the handling of systems where centrifugal force is not necessary for phase separation.

The Spiradyne plant is available in capacities ranging from 20 c.c.p.m. to



Podbielniak extraction plant

20 g.p.m. The plant consists of a gravity-type column designed with highly-efficient impeller mixing sections. The sections are assembled on a rotating shaft controlled by a variable speed drive unit. The clarification sections are packed with coalescing materials necessary for phase disengagement.

The assembly contains many flexible features for handling a wide variety of solvent extraction systems. Sufficient mixing and clarifying sections can be combined in a single unit to provide a range of definitely 'identifiable' stages as may be required—up to 10 or more.

PLANT STREAM GAS ANALYSER

Latest of the Mervyn range of instruments is the Mervyn plant stream gas analyser which will measure and record the amount of one component in a multi-component gas stream. Gases that have been successfully tried include ammonia, oxygen, carbon monoxide, carbon dioxide, sulphur dioxide, and hydrogen sulphide.

Stream gas is sampled and passed through an absorber column where it reacts with a suitably chosen reagent. The resulting change in conductivity is a function of the desired component's concentration.

In operation adjacent arms of a pair of conductivity cells are arranged in a self-balancing a.c. bridge. With no gas input the reagent solution when passing through the cells leaves the bridge in a balanced condition. If gas is now allowed to react with the solution after it has left the first cell the resulting change in conductivity will affect the second cell. The unbalance voltage can then be amplified and used to drive a motor geared to one of the opposite-arm resistors and the recorder pen. The balancing mechanism is a modified Honeywell-Brown circular chart recorder.

Calibration and zero of the instrument in terms of gas concentration are established at certain reagent and gas flow rates which are set and indicated on the instrument's control panel. Conductivity and absorber columns are maintained at a uniform temperature in a stirred oil bath. The reagent solution is protected from atmospheric attack and the instrument zero set by a supply of stream gas from which the indicated component has been scrubbed.

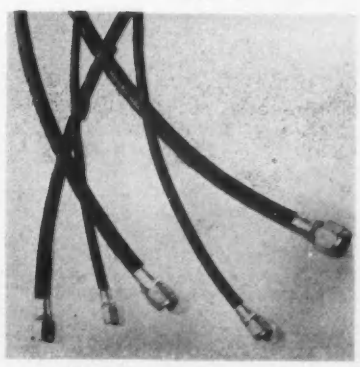
The makers are **Mervyn Instruments Ltd.,** Woking, Surrey.

COUNTER WITH ELECTRIC RESET

The type 100 electromagnetic counter can now be supplied by **Counting Instruments Ltd.,** 5 Elstree Way, Boreham Wood, Herts, with electrically operated resetting facilities. This takes the form of a solenoid mounted at the rear of the case which, momentarily energised, operates the resetting mechanism. A number of counters can be rest to zero at the same time by operating a push-button switch, which can be situated remotely from the counters, and the counter can be electrically reset when operating without causing any damage to the counter mechanism.

FLEXIBLE PRESSURE HOSE

Nylaflow flexible pressure hose, manufactured by **Polypenco Ltd.,** 68-70 Tewin Road, Welwyn Garden City, Herts, consists of a polyamide (nylon) inner tube reinforced with high tensile strength yarn. Advantages claimed for it are: outstanding resistance to flex, pressure pulse and vibrational fatigue, unique light weight and small outside to inside diameter ratio, operating temperature range of minus 80 to 250°F (intermittently from minus 200 to 300°F, exceptionally low Freon permeability (approximately one-tenth that of rubber hose) will not swell in standard and non-flammable hydraulic fluids, etc. The hose is available in continuous lengths in two pressure grades, No. 800 having minimum burst pressure of 8,000 p.s.i. and No. 500, 5,000 p.s.i.



Nylaflow pressure hose

SCOTTISH FIRM SECURES SOVIET ORDER FOR PLASTICS MIXERS

A RUSSIAN order for more than £70,000 worth of plastics mixing machines has been placed with the Morton Machine Company Ltd., Wishaw, Scotland.

The machines, ordered by Techmashimport, Moscow, are FKM 300 DK Lodige-Morton mixers for plasticising powders such as p.v.c. and polyvinyl acetate by the dry powder method or dry blend. Each machine will handle 500 lb. of plasticised powder an hour and, as it is fitted with twin barrels, can discharge continuously, directly into the feed hopper of an extruder.

The machine consists of an upper circular mixing vessel jacketed for steam at 300°F. Inside this vessel, double plough shaped shovels rotate on a shaft. Attached to the doors of this upper vessel, which is filled to 60% of its capacity, are perforated plates. The shovels revolve between these plates, picking up the mix and rubbing it through the holes in the perforated plates. In this way polymer, stabiliser and fillers are accurately mixed.

While this mixing is taking place the materials are being heated and dried by means of the steam jacket on the outside. The drying takes place quickly since the whole drum is covered by the jacket and the materials are in violent agitation. Plasticiser is added in thin streams during the heating process and on completion the dry blend is discharged to the lower jacketed vessel through a transfer tunnel.

This lower drum also has mixing shovels and serves to cool the mix or maintain it at a reasonably average temperature for continuous feeding to an extruder or into containers. Further plasticiser or colours can be added in the lower cooling vessel. The mix in all cases discharges as a fine dry powder or granulate.

B.D.H. Reagent for Estimating Phenol

ALTHOUGH useful reducing agents in chemistry, the *N* : *N*-dialkyl *p*-phenylene-diamines (*p*-amino-anilines) suffer from the disadvantage that the bases and the mineral acid salts are subject to oxidation both in the solid state and solution. The oxalic acid salts, report B.D.H. Laboratory Chemicals Division, British Drug Houses Ltd., Poole, Dorset, which can be used in many instances, are much more stable to oxidation. A solution of *p*-amino-diethyl-aniline prepared from the oxalate salt and used as an indicator in volumetric and colorimetric methods for the estimation of chlorine, chloramine, dichloramine and nitrogen trichloride in domestic water supplies, can be kept for at least a month without decomposition.

Another new reagent listed by B.D.H. is *p*-amino-*N* : *N*-dimethyl-aniline oxalate. This has been suggested by the joint A.B.C.M.-S.A.C. Committee on Methods for the Analysis of Trade Effluents as a reagent for estimating phenol, with which it gives a blue colour in the presence of a mild oxidising agent. The oxalate salt is sufficiently stable to be used in the method without further purification.

Use of 1-chloro-methyl-naphthalene as a catalyst for the photo-sensitising of styrene, acrylate and vinyl esters is referred to in U.S. Patent No. 2,548,685. The chemical can now be obtained in the form of a white crystalline powder melting at 31 to 33°C from B.D.H.

Homomenthyl salicylate, a clear liquid, has been added to the list. It shows almost complete optical absorption over the range 220 to 350 mμ. Other additions are ethanolamine-phosphoric acid and its barium salt. The free acid is a white readily water-soluble crystalline powder free of water of crystallisation. The barium salt, also a white crystalline powder, is readily soluble in water, but contains some 8% of bound water. Phospho-ethanolamine (2-amino-ethanol 1-phosphoric acid) has been isolated from cancer tissues. It is believed that it may play a part in phospholipid metabolism.

I.C.I. Spent £300 m. on Plant in 9 Years

BETWEEN 1948 and 1957 Imperial Chemical Industries invested £300 million in new plants and processes, Mr. Leslie Hall, a joint managing director of the Nobel Division, stated at a dinner in Dumfries. Last year the sum invested was about £50 million.

Referring to developments in the Nobel Division, he said that among the major items were the mechanised unit at Misk, two new Biazzi remote controlled plants in Ardeer, the Ardeer oleum plant, the new power station and the plant to manufacture isopropyl nitrate.

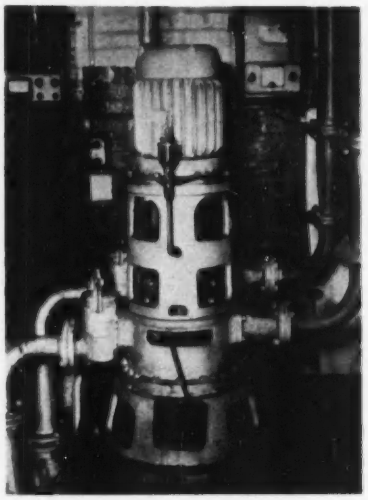
The distribution system had been rationalised within the division and new depots had been built to serve the main consuming centres. The entire fleet of coasters operated by the division had been replaced with diesel-driven ships.

There had been big developments with pentaerythritol and the new plant was approaching the designed level of production.

Mr. Hall said the lifting of dollar restrictions had increased competition from Canada, particularly with pentaerythritol in the home market. The export effort with all products was encountering intensified competition.

Two Effluent Pumps Give 8-Years Service

Two LaBour G-type vertical pumps have completed eight years' service with Williams (Hounslow) Ltd., Hounslow, Middx., handling works effluent which has a pH range of 3 to 12 before treatment. In these eight years the two pumps have handled 208,000,000 gallons of effluent. They work for 100 hours a week and have been used continuously. The total maintenance cost has been only £32 10s and the original casings are still in use. Other LaBour pumps are also in use on other duties. Three have eight years' service and cost £13 for maintenance in that period. Three others have four years' service, one on 13% sulphuric acid, and maintenance charges have been nil.



One of the LaBour vertical pumps

Conference on Detergents

A one-day conference with the title 'Detergents, textiles and colour' is to be held by the Textile Institute at the Lesser Free Trade Hall, Manchester, on 11 February. A paper on the difficulties of reconciling opposing needs in the production and use of detergents will be given by Mr. F. P. Thompson (Unilever Ltd.). Mr. G. S. J. White (I.C.I. Dyestuffs Division) will talk about the problems of the producer of dyes and chemicals. A general discussion will be initiated by Dr. A. S. C. Lawrence (Sheffield University).

Recent Advances in Spectroscopy

A short course on recent advances in spectroscopy is to be held at the Coventry Technical College on 12 and 13 March. Lecturers, who will cover u.v., i.r., atomic and microwave spectroscopy, nuclear magnetic resonance and electron spin resonance are: Dr. J. C. Brand, Dr. L. J. Bellamy, Dr. L. Bovey, Dr. L. Thomas, Dr. J. A. Smith and Dr. D. H. Whiffen.

PEOPLE in the news

● PROFESSOR FRANK MORTON, Ph.D., D.Sc., F.R.I.C., M.I.Chem.E., Professor of Chemical Engineering at Manchester College of Science and Technology, was last week elected chairman of the North-Western branch, Institution of Chemical Engineers. He succeeds MR. H. E. CHARLTON (H. E. Charlton Engineers Ltd.) who becomes vice-chairman. MR. R. J. KINGSLEY (Lankro Chemicals Ltd.) was re-elected hon. secretary and DR. J. S. HUNTER (U.K. Atomic Energy Authority) was appointed hon. treasurer in succession to DR. T. K. ROSS. Elected to fill vacancies on the committee were: G. K. DICKSON (U.K. Atomic Energy Authority), G. OGDEN (Hardman and Holden Ltd.) and E. WOOLLATT (Lever Brothers Ltd.).

● MR. P. G. SMYRK has joined the board of Johnson, Matthey and Co. Ltd. as joint managing director. He has hitherto been manager of the export division of the company and a director of several of its overseas subsidiaries.

● Owing to the continued expansion of the Foundry Services Group, MR. E. WEISS has relinquished his position of managing director of Foundry Services, Ltd., Long Acre, Nechells, Birmingham 7, so that he can give more time to directing the parent company, Foundry Services International Ltd. DR. D. V. ATTERTON has been appointed managing director of Foundry Services Ltd.

● The council of the Geological Society of London have awarded a moiety of the Lyell Fund to MR. C. O. HARVEY, chemist to the Geological Survey of Great Britain, 1934-58, for services in aiding geology by chemical analysis of rocks and minerals.

● DR. J. G. WATKINSON has been appointed a lecturer in chemistry at Manchester University.

● Appointments in the Beecham group include MR. J. O. RINTOUL, formerly assistant managing director of the group and managing director of Beecham Foods, to be a vice-chairman of the group. MR. N. F. FABRICIUS has been appointed chairman of Beecham Maclean and MR. A. E. V. HOUCHEN chairman of County Laboratories. MR. A. C. FABRICIUS has been appointed chairman of Beecham Overseas and MR. E. P. GODDEN managing director of Beecham Overseas. MR. R. W. MURPHY has been appointed managing director of County Laboratories.

Two guests of the North-western branch, Institution of Chemical Engineers, at the annual dinner were C. S. Rees (Associated Ethyl) with Mrs. Rees (see also p. 242)

● DR. D. F. RUSHMAN has been appointed chief chemist of Kay Brothers Ltd., manufacturing chemists of Reddish, Stockport. Dr. Rushman has, for a number of years, held a senior position at the Paint Research Station, Teddington. Prior to joining Paint Research, he spent some time at the Radiochemical Centre, Amersham.

● MR. J. KENNETH WEIR has been elected a director of the International Nickel Company of Canada and a member of its advisory committee. The vacancy on the board was caused by the retirement of his father, VISCOUNT WEIR.

● MR. P. S. RENDALL, a deputy chairman and a managing director of Courtaulds Ltd., has been appointed chairman of the Man-Made Fibres Producers' Committee. He succeeds MR. A. D. CARMICHAEL.

● MR. REGINALD G. HOARE, M.P.S., development director, I.C.I. Pharmaceuticals Division, is a member of the British trade and industrial mission which will leave for Ghana on 8 March. His main interests in Ghana will be pharmaceuticals, chemicals and insecticides.

● MR. H. P. DEAN, in charge of ammonia design section at the engineering department of I.C.I. Billingham Division from 1951 to 1958, when he was seconded to African Explosives and Chemical Industries as liaison engineer working at Billingham, has retired after 31 years on Tees-side. He will, however, still work at Billingham, for he has been asked to continue his work for A.E. and C.I. in a consultative capacity.

● MR. R. E. WILSON, managing director of Fescol Ltd., London N.7, retired on 31 January. He joined the company in 1928 and during his long service has guided it through a period of considerable expansion. Succeeding him as managing director is MR. F. B. STRACHAN, who joined the firm in 1925 on the financial side and was appointed secretary in 1928. He has been assistant managing director since 1951. Under consequent staff changes, MR. W. A. LESLIE continues as director and sales manager; MR. F. BADEN is appointed works manager in London and MR. C. W. HAY succeeds him at Port Glasgow. MR. A. E. LOCKLEY is appointed works manager in Huddersfield, and MR. R. F. BURKE becomes works manager of the Midlands plant.

● The board of Cooke's Explosives Ltd. has been reconstituted as follows: DR. J. M. HOLM, chairman, DR. G. BRYCE, MR. R. G. HAWKINS, MR. F. G. O'HANLON, MR. A. J. SILVESTER. The reconstitution follows the retirement of MR. R. T. Cooke, chairman, and the relinquishment of his appointment on the board by Dr. James Craik, I.C.I. Nobel Division chairman.

● At the annual general meeting of the Western section of the Society for Analytical Chemistry in Cardiff the following officers were elected: Chairman, MR. S. DIXON; vice-chairman, DR. G. V. JAMES; hon. secretary and treasurer, DR. T. G. MORRIS, Brockleigh, Clevedon Avenue, Sully, Glamorgan.

● MR. R. W. STOBBS, F.R.I.C., F.I.M., has been appointed general manager of Preformations Ltd, Cheney Manor, Swindon, the company recently formed by the Plessey Co. Ltd. and the Arnold Engineering Co., of Illinois, for the manufacture of Magloy permanent magnets. Mr. Stobbs joined the Plessey Co. Ltd. five years ago as principal metallurgist at the company's Ilford factory. Previously, he was for three years chief research metallurgist with the foundry division of David Brown Industries Ltd., before which he was with Ford Motor Co. Ltd. as a metallurgist.

● MR. G. D. SIM has been appointed manager of the raw materials group in the purchasing department of Monsanto Chemicals Ltd. He joined Monsanto 12 years ago and for the past two years has been overseas sales supervisor.

● MR. S. J. TUNGAY, general manager of Haughton's Metallic Co. Ltd., is retiring after 70 years with the company. MR. F. MENET, who has been in the company's service for some 40 years, takes over as general manager.

Obituary

MR. SIDNEY DANIEL CHALONER, managing director of Chemical Extractions Ltd. since 1950, died on 21 January.

DR. PERCIVAL THOMAS CARTER, senior lecturer in metallurgy at the Royal College of Science and Technology, Glasgow, was killed on 1 February trying to save a fellow climber on Stob Coire an Lochan, Glencoe. Dr. Carter joined the staff at the Royal College soon after graduating from King's College, Newcastle, shortly before the outbreak of World War II.

Commercial News

- **Anglo-French Phosphate Profit Halved**
- **Hilger and Watts Pay Special Interim**
- **Hoechst 1958 Chemical Sales Up 7.3%**
- **U.S. Borax Report Year-End Recovery**

Anglo-French Phosphate

The Anglo-French Phosphate Co. Ltd. announce a dividend of 20% for 1958 and an interim of 10% for 1959, compared with 30% for 1957. The net profit was £22,977 (£48,638) after tax of £28,950 (£68,350). The directors state that the sale of most of the shares held in the Compagnie Francaise des Phosphates de l'Oceanie, almost all before the payment of a dividend, caused the large fall in profits. They expect to complete the realisation of the company's assets shortly.

Hilger and Watts

Group profits of Hilger and Watts Ltd. rose from £181,062 to £226,130 for the year ended 30 September 1958. This followed a rise from £123,479 the previous year. The final dividend is 8%, making 13% as previously, but there is in addition a special interim of 2%. Net profit after tax is £112,754 compared with £87,690.

Royal Worcester Ltd.

Under an international group reorganisation, the Worcester Royal Porcelain Co. Ltd. have become a holding company and have changed their name to Royal Worcester Ltd. Two new wholly-owned subsidiaries have been formed, the Worcester Royal Porcelain Co. Ltd., to deal with the production and sale of fine china and porcelain at Worcester, and Royal Worcester Industrial Ceramics Ltd., to handle the manufacture and sale of industrial ceramics at the Tonyrefail factory, South Wales.

United Glass Ltd.

United Glass Ltd. will be the future name of the United Glass Bottle Manufacturers Ltd. The company state that as well as being rather long the old name gave a limited impression of the scope of their interests.

The authorised share capital has been increased by £1 million to £5,450,000, but the board state that they have no immediate intention of issuing any of the additional capital. Before any issue that may affect the control of the company the approval of shareholders will be sought.

Degussa, Frankfurt

Deutsche Gold und Silber Scheideanstalt (Degussa), Frankfurt, are paying a dividend of 14%, which means there has been a rise in dividend for four years in a row. Dividend for 1956-57 was only 11%, for the previous year 10% and for 1954-55 9%.

Turnover was up by 5% on the previous year, but the increase was lower than in former years, mainly because of stiffer competition which had forced down many of the company's prices. Profit, at DM 14,290,000, was up by DM 4,190,000.

The chairman states that sales of oxidising and bleaching agents were not very satisfactory. The company's plants for the production of cyanide and prussic acid were in full production but prices fell off, especially for pharmaceutical raw materials. This was also the case with carbon black, which was produced at full capacity. Home sales of methanol derivatives were at last year's levels, and exports rose.

Hoechst A.G.

West German chemical producer, and a successor company to the I.G. Farben concern, Farbwerke Hoechst A.G., of Frankfurt, have announced that their turnover last year totalled DM 1,890 million (approx. £157½ million), as against DM 1,760 million (about £146¾ million); this constitutes a rise of 7.3% as compared with an overall turnover increase for the country's chemical industry for 1958 (current figures) of only 5%.

In the past financial year the company's home sales rose by 9.2%, but owing to the growing export difficulties, foreign sales fell 2.8% below the average. The share of export sales in the company's overall sales has fallen from a 1957 figure of 32.3% to one last year of 31%. Trade with North and South America made good progress despite the unsatisfactory position of the chemical market there and Middle East sales fell off. Sales in the Far East developed well except to Communist China.

Investments made during the year came to DM 241 million (approx. £20 million), as against DM 231 million (some £19¼ million) in 1957. Investments of over DM 200 million are also foreseen for 1959. During last year some DM 92 million (about £7¾ million) was spent on research, as against DM 88 million (about £7¼ million) in 1957. This meant that over the year the amount spent on research as part of the turnover fell to 4.9%; Prof. Winnacker states that this is almost exactly the average percentage for the German chemical industry as a whole.

The pressure on prices, general for German chemical manufacturers, led to the dropping of Hoechst's prices by an average of 1.5%.

U.S. Borax and Chemical

A recovery in earnings is reported by the United States Borax and Chemical Corporation, the American operating company of Borax (Holdings) Ltd. In the last quarter of 1958 net income amounted to $1,093,248, or 22 cents a common share. This compares with a net loss of $141,940 after taking into account a tax credit of $154,000 for the same quarter of 1957. Dollar sales in the December quarter were nearly 24% higher than in 1957, reaching a record of $14,523,578.

Demand for boron products in both the domestic and export markets was generally strong. Potash sales were higher, but this owed a good deal to lower prices.

An agreement was made with the Dow Chemical Co. to perfect an economic method of manufacturing boron trichloride, from which most of the new boron compounds can be made.

Du Pont of Canada

Sales by the Du Pont Co. of Canada rose by 12% to $81.7m in 1958. Net income was $5,235,000, equal to 70 cents per common share, compared with $4,491,000 or 60 cents a share previously.

I.C.I.A.N.Z.

Group net profit of Imperial Chemical Industries of Australia and New Zealand advanced by £A635,843 to a record £A3,007,129 in the year ended 30 September 1958, after tax of £A2,064,638 (£A1,785,550) and depreciation £A1,847,924, etc. Assets have risen from £A45 million to £A53 million.

INCREASE OF CAPITAL

ARTHOL LTD., perfumery manufacturers etc. Brassey House, New Zealand Avenue, Walton on Thames, Surrey. Increased by £24,900 beyond the registered capital of 100.

LONDON GAZETTE

Voluntary Winding-up

(Notice of a company voluntarily winding-up is purely formal and does not imply insolvency. It is frequently for purposes of internal reconstruction.)

D. SALMOND AND NEPHEW LTD., soap and oil manufacturers and merchants, reg. office, 2 Scoresby Street, Bradford. By special resolution, 10 December. L. N. Hickson, 2 Scoresby Street, Bradford, appointed liquidator.

R. T. COOKE LTD., colliery explosive merchants, regd. office, Annfield Plain, Co. Durham. By special resolutions, 23 January. Mr. R. P. Winter, 16 Market Street, Newcastle upon Tyne 1, appointed liquidator.

Notice of Dividend

LAMARNE LABORATORIES LTD., reg. office, 20 High Street, Sutton, Surrey, manufacturing chemists. First and final dividend of 1s. 11 7/16d. per £ to be paid on 27 January, or on any subsequent day except Saturday, between 11 and 2, at the office of the Official Receiver and Liquidator, Inveresk House, 346 Strand, London W.C.2.

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TRADE NOTES

Plasticisers Price Cuts

Prices of the higher phthalate plasticisers of the Distillers Company Ltd. have been cut by £8 a ton. Those affected are Bisoflex 88, 91 and 791. The company's plasticiser rebate scheme has been discontinued at the request of customers.

The new prices, per ton for 10-ton lots in drums are: dibutyl phthalate, £206; diethyl phthalate, £183 10s.; dimethyl phthalate, £175.

Contact Adhesives

One-dimension contact adhesives based on Polybond Universal adhesive are announced by Polybond Ltd., 16 Gloucester Place, London W.1. A new technique gives an instantaneous bond on contact at right angles to the job but gives complete freedom of movement in the plane of the job. This means that there is ample time for moving the object into its correct position, yet it cannot be removed from the surface. Tiles and plastics sheets can be fixed to all surfaces, and metal sheets can be attached to a wide variety of surfaces.

High Duty Alloys

It is announced by High Duty Alloys Ltd. that their Midland office is located at Queen's College Chambers, 38a Paradise Street, Birmingham 1, telephone Midland 3286. The office will handle hiduminium sheet, extrusion tube and casting for the convenience of customers in that area. All market inquiries and quotations in regard to forgings will be dealt with from a new sales office situated at the forging division, Windsor Road, Redditch, telephone Redditch 711.

Marine Drying Oils

Chas. H. Windschuegl Ltd., 1 Leadenhall Street, London E.C.3, agents for Marine Oil Refiners of Africa Ltd., announce that a programme of research on Marinol K and its derivatives has commenced in London. The object is to provide an up-to-date information service to paint and allied industries on the performance of Marinol K as a drying oil. Initially the work will be mainly concerned with the use of Marinol K in the preparation of alkyd resins.

Radiographic Equipment

A new firm, R. F. Fraser-Smith, 69 King's Cross Road, London W.C.1 (Terminus 1064) is able to supply radiographic equipment and accessories. In particular they are manufacturers of gamma ray equipment of a new design.

Kleemann Agreement with U.S.I.

O. and M. Kleemann have entered into an agreement with the U.S. Industrial Chemicals Co., a subsidiary of the National Distillers and Chemical Corporation of America, for the sole representation and distribution in the U.K. of its polythene resins, sold under the trade name Petrothene. Erinoid Ltd., a Kleemann subsidiary, will distribute the resins. They will stock a wide range of the resins at their Welwyn Garden City distribution centre.

Special grades of Petrothene resins are available for film, injection moulding, coating, cable and wire covering and bottle blowing.

Fuel Additive Data Sheets

Information about a series of fuel additives announced during the past year by the Amber Chemical Co. Ltd., 11a Albemarle Street, London W.1, is now summarised in a set of data sheets, available on application to the company.

Market Reports

Buying is Well Spread

LONDON. Conditions are unchanged on the week with home trade in industrial chemicals following a steady course, and fair quantities moving against contracts. Buying activity has been well spread over most of the consuming industries but the outlet for chemical products in the cotton and kindred trades remains dull.

As regards prices, most items continue steady at recent levels, but quotations for the non-ferrous metal compounds have been influenced by the fluctuations in metal prices. Zinc oxide prices lost their upward turn, and from 26 January the red seal has been £25 10s. per ton, as given in the price list last week. Copper sulphate is currently quoted at £76 10s. per ton, less 2% f.o.b. Liverpool, showing an increase of 50s. per ton.

The call for agricultural chemicals is seasonally slow, and there is nothing of fresh importance to record for the coal-tar products. A steady demand has been reported for pitch and naphthalene.

MANCHESTER On the Manchester market for heavy chemical products during the past week the only price changes of any consequence have been a further advance in sulphate of copper by £2 a ton and the sharp increases in the chemically pure and technical grades of glycerine. The demand for textile chemicals from the cotton and allied industries has been only moderate, but most other industrial outlets are specifying for reasonably steady deliveries against contracts. Shipping business has been about maintained. Fertilisers have been a little livelier, mainly in the compounds and the nitrogenous materials.

GLASGOW. Apart from some sections of the heavy industries which have shown a tendency to be quieter, the trading position during the past week has remained fairly active. Demands mostly against current requirements have been well up to normal, with some forward bookings placed. The price position generally had a tendency to firmness, with some increases. Export trade is still keeping at a good level.

NEW PATENTS

By permission of the Controller, HM Stationery Office, the following extracts are reproduced from the 'Official Journal (Patents)', which is available from the Patent Office (Sale Branch), 25 Southampton Buildings, Chancery Lane, London W.C.2, price 3s 6d including postage; annual subscription £8 2s.

Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

AMENDED SPECIFICATIONS

On sale 11 March

Heat producing mixtures. Foundry Services Ltd. **774 490**

Heat producing agents. Foundry Services Ltd. **774 491**

ACCEPTANCES

Open to public inspection 11 March

Polyvinyl oxo-alkanals. Esso Research & Engineering Co. [Addition to 785 193.] **810 259**

Heat-joining of polished surfaces of pieces of glass. American Optical Co. **810 260**

Manufacture of unsaturated aliphatic ketones. Hoffmann-La Roche & Co., A.G., F. **810 078**

Dehydrogenation of organic compounds. Bataafsche Petroleum Maatschappij N.V., De. **810 340**

Process for the preparation of cable-impregnating oils. Bataafsche Petroleum Maatschappij N.V., De. **810 079**

Liquid distributer for ion-exchange filters. Ladendorf, A., and Ladendorf, K. [trading as Bran & Lübbe]. **810 342**

Processing photographic diazotype materials. General Aniline & Film Corp. **810 081**

Condensates of epoxy fatty acids or esters with polyamines. General Mills, Inc. **810 348**

Cooling crystallisers. Zdansky, E. A. **810 187**

Method of increasing the resistance of metals to wear and seizing. Ateliers Partiot Cementation. [Addition to 795 076.] **810 370**

Ethylene/isobutylene copolymer. Montecatini Soc. Generale Per L'Industria Mineraria E Chimica, and Ziegler, K. [Divided out of 810 023.] **810 024**

Open to public inspection 18 March

Recovery of plutonium. Duffield, R. B. **810 541**

Recovery of protoactinium. Stoughton, R. W. **810 542**

Containers for molten metal. Continuous Casting Co. Ltd. **810 653**

Manufacture of polyethylene plastic films. British Cellophane, Ltd. **810 474**

Electrolytic treatment of metals and alloys for the removal of metal from the surface thereof. Charlesworth, P. A. **810 475**

Treatment bath and process for treating metal surfaces. Farbwerke Hoechst A.G. **810 546**

Fused salt baths. Imperial Chemical Industries, Ltd. **810 476**

Process for fixing pigments on fibrous materials or foils. Farbwerke Hoechst A.G. **810 548**

Unsaturated polycyclic sulphites and a process for their manufacture. Farbwerke Hoechst A.G. **810 602**

Method for producing fireproof plastics material and fireproof plastics materials obtained therethrough. Samuel, A. A. [Addition to 721 706.] **810 551**

Apparatus for testing a characteristic of ferromagnetic materials. Villamosipara Központi Kutato Laboratorium. **810 423**

Ester synthesis. Goodrich Co., B. F. **810 381**

Production of trichloroacetic acid and its functional derivatives. Monsanto Chemical Co. **810 461**

Plasticisers for cellulose derivatives. British Celanese, Ltd. **810 557**

Tallow emulsions, and applications thereof. Mercer, E. **810 383**

Semiconducting elements of silicon. General Electric Co. **810 558**

Processes for recovering solid ammonium sulphate from aqueous solutions thereof. Oesterreichische Stickstoffwerke A.G. **810 481**

Production of high molecular weight polymers of ethylene. Ruhrchemie A.G. [Addition to 808 361.] **810 484**

Cracking petroleum products to obtain gases. Soc. P. A., Forni ed Impianti Industriali Ingg. De Bartolomeis. **810 373**

Alkylarylsulphonyl derivatives of amino acids to corrosion and rust inhibiting compositions thereof and their use. Geigy A.G., J. R. **810 560**

Synthesis of 1, 4-dicaffeylquinic acid. Farmaceutici Italia S.A. [Addition to 802 668.] **810 375**

Polymeric material containing a dispersion of metal particles. General Electric Co. **810 386**

Dehydration and process of gas streams. Parks, A. S. **810 657**

Ceramic substance and method of making. Lyons, S. C. **810 487**

Synthetic rubber-like materials. Imperial Chemical Industries, Ltd. **810 489**

Processes for sweetening hydrocarbon oils. Bataafsche Petroleum Maatschappij N.V., De. **810 490**

Oxidation resistant graphite articles. Union Carbide Corp. **810 491**

Process for sweetening sour petroleum fraction. Esso Research & Engineering Co. [Cognate application 5 325.] **810 567**

N-Morpholyl-substituted ketones with fungicidal action and a process for production thereof. Farmaceutici Italia S.A. **810 497**

Polymerisation process. Distillers Co., Ltd. [Cognate application 12 266.] **810 388**

Process and apparatus for granulating materials solidifying from molten state. Ruhrchemie A.G. **810 469**

Triazine derivative. Imperial Chemical Industries, Ltd. **810 568**

Sulphide derivatives. Beecham Research Laboratories, Ltd. **810 389**

1, 2-Epoxy-2-methyl pentane and its conversion to 2-methyl-pentanol-1. Imperial Chemical Industries, Ltd. **810 500**

Penicillin salts of aminoguanidines. Imperial Chemical Industries, Ltd. **810 569**

Carboxymethylation of primary and secondary amines. Geigy A.G., J. R. **810 501**

Treatment of aqueous solutions containing alkali-metal salts of terephthalic acid. Henkel & Cie G.m.b.H. **810 552**

Ion-exchange membranes. Permutit Co., Ltd. **810 391**

Process for the production of a sound-absorbing layer on immersed walls at the boundary surfaces of liquids. Wiederhold, W. [trading as Komm.-Ges. H. Wiederhold.] **810 505**

Method of producing copper strip from the powdered metal. Heck, F. **810 678**

Hydroxylated benzophenone ethers. American Cyanamid Co. **810 570**

Compositions adapted for use in bonding resins to glass. United States Rubber Co. **810 510**

Copolymers of trifluoroethyl vinyl ether and chloro-olefins. Air Reduction Co., Inc. **810 515**

Penicillin compounds and intermediates for use in their production. Leo Industrie Chimiche Farmaceutiche. **810 518**

Fungicidal compositions. Imperial Chemical Industries, Ltd. **810 377**

Fungicidal compositions containing griseofulvin. Imperial Chemical Industries, Ltd. **810 378**

Preparation of cross-linked polysiloxanes. General Electric Co. **810 684**

Lubricating oil compositions. Bataafsche Petroleum Maatschappij N.V., De. **810 685**

Method and apparatus for removing entrained moisture from oil. Hydro Equipment Corp. **810 521**

Production of artificial yarns and films from viscose. Vereinigte Glanzstoff-Fabriken A.G. **810 687**

Detergent compositions. Hedley & Co., Ltd., T. **810 688**

Ozonisation of olefinically unsaturated fatty acids and products obtained thereby. Boake Roberts & Co., Ltd., A. **810 571**

Producing normally solid polymers or copolymers from ethylene. Standard Oil Co. **810 572**

Process and apparatus for fractionating solid materials. Cabot, Inc., G. L. **810 630**

Antiozonation of rubber. Universal Oil Products Co **810 529**

Production of aromatic amines. Distillers Co., Ltd. **810 530**

Dehydrating and removing adsorbable components from gas streams. United Gas Corp. **810 700**

Device for the de-gasification of high pressure liquid in hydraulic power installations. Süddeutsche Kühlerfabrik J. F. Behr. **810 635**

Filter concentrators. Krauss-Maffei-Imperial G.m.b.H. & Co. **810 701**

Aqueous coating compositions and coated substrates. Rohm & Haas Co. **810 575**

Production of multivalent metals and non-metals. National Distillers & Chemical Corp. **810 428**

Polyolefins prepared by the low-pressure process. Chemische Werks Hüls A.G. **810 576**

Silicone elastomers. General Electric Co. **810 532**

Manufacture of lubricating oil additives. Shell Research, Ltd. [Addition to 801 418.] **810 450**

1, 1, 2-Tri-(1-cyanoethyl) hydrazine. American Cyanamid Co. **810 403**

Stabiliser for oleaginous products and stabilised oleaginous products. Taylor, J. J. **810 538**

Manufacturing titanium and titanium alloys. Oregon Metallurgical Corp. **810 533**

Manufacture of structural components consisting of glass material and an unsaturated polyester resin. Zeiss-Stiftung, C. [trading as Jenaer Glaswerk Schott & Gen.] **810 577**

Vinyl resin compositions stabilised with lead chloride—lead silicate complexes. National Lead Co. **810 578**

Process for reducing finely divided iron ore. Stora Kopparbergs Bergslags A.B. **810 638**

Manufacture of lubricating oil additives. Shell Research, Ltd. [Addition to 801 418.] **810 641**

Preparation of esters of acylphosphorous acids. Henkel & Cie G.m.b.H. **810 642**

DIARY DATES

MONDAY, 9 FEBRUARY

R.I.C.—Leeds: Chemistry Lecture Theatre, Univ., 6.30 p.m. 'Gas chromatography', by J. H. Purnell.

TUESDAY, 10 FEBRUARY

R.I.C.—London: Sir John Cass College, Jewry St., E.C.3, 6.0 p.m. 'Vitamin B_{12}—recent advances', by E. Lester Smith.

R.S.A.—London: John Adam St., W.C.2, 5.15 p.m. 'History of African pyrethrum industry', by T. F. West with Sir Ian Heilbron in the chair.

S.C.I.—London: 14 Belgrave Sq., S.W.1, 6.0 p.m. 'Extraction of thorium', by W. D. Jamrack, R. A. Wells and J. H. Buddery.

Soc. Instrument Technology—Manchester: Central Library, 6.30 p.m. 'A contractor's approach to instrumentation', by J. Sheraton.

WEDNESDAY, 11 FEBRUARY

B.A.C.—London: Wellcome Research Institute, Euston Rd., N.W.1, 7.0 p.m. 'Disposal of effluents of chemical works', by J. L. Hewson.

Plastics Inst.—Leeds: St. Marks House, 186 Woodhouse Lane. 'Man-made fibres', by J. B. Speakman.

S.A.C.—Birmingham: University, 6.30 p.m. 'Recent advances in analytical chemistry of polymers', by Dunlop workers.

S.C.I.—London: 14 Belgrave Sq., S.W.1, 6.30 p.m. 'Recent research on corrosion of tinplate', by S. C. Britton and K. Bright.

S.C.I. with C.S. and R.I.C.—Belfast: Chemistry Dept., Queen's Univ., 7.15 p.m. 'Selection of bituminous road surfacings and the control of their manufacture and laying', by H. G. Barnes.

Textile Inst.—Manchester: Lesser Free Trade Hall. One-day conference on 'Detergents, textiles and colour'.

THURSDAY, 12 FEBRUARY

C.S.—London: Large Chemistry Lecture Theatre, Imperial College, S.W.7, 7.30 p.m. Pedler lecture: 'Polyacetylenes', by E. R. H. Jones.

I.Chem.E.—London: Church House, S.W.1, 9.30 a.m. Symposium on mass transfer.

R.S.—London: Burlington House, W.1, 4.30 p.m. 'Chester Beatty Research Institute', by A. Haddow.

S.C.I.—Liverpool: College of Technology, Byrom St., Liverpool, 7.30 p.m. 'Chemical effects due to fission fragments', by R. Spence.

S.C.I.—Aberdeen: Marischal College, 6.30 p.m. Section a.g.m.; with **C.S. and R.I.C.**, 7.45 p.m. 'Ion-exchange resins and membranes', by F. L. Tye.

FRIDAY, 13 FEBRUARY

C.S.—St. Andrews: Chemistry Dept., St. Salvator's, 5.15 p.m. 'Some aspects of search for new drugs', by H. T. Openshaw.

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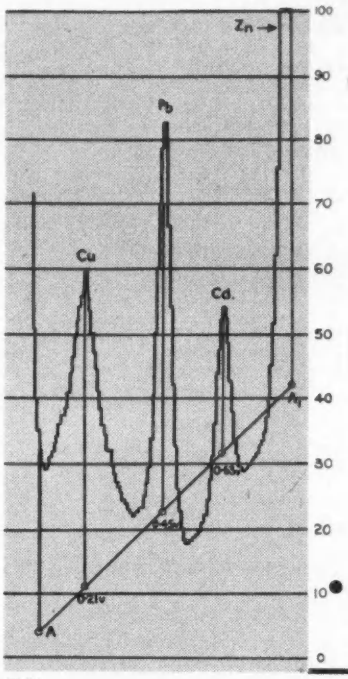

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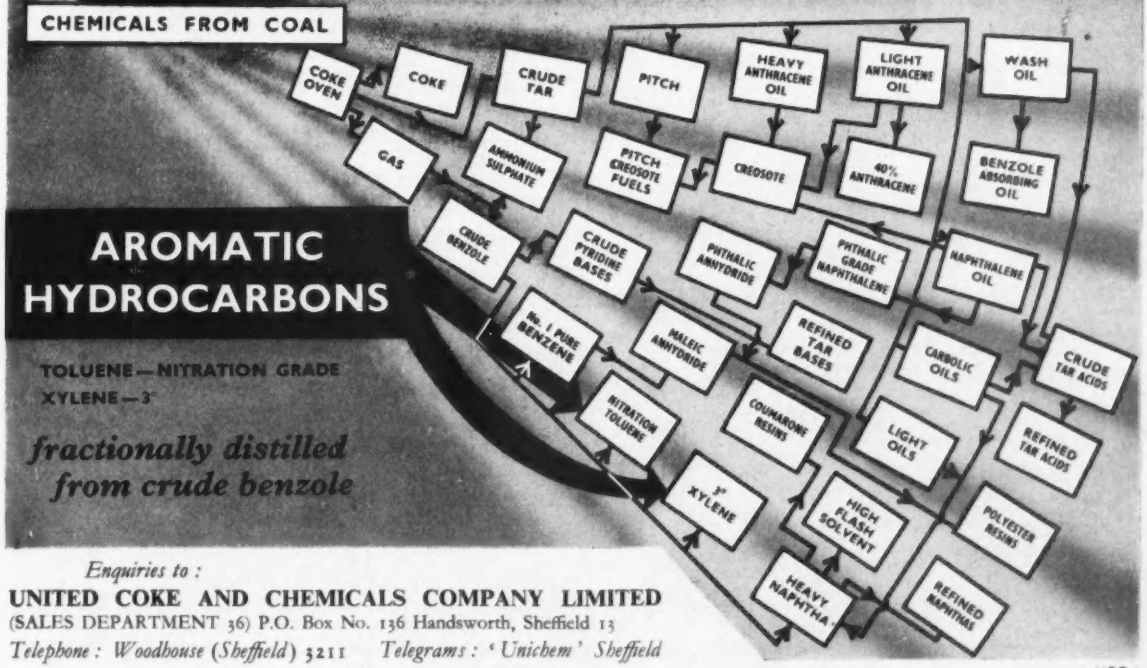

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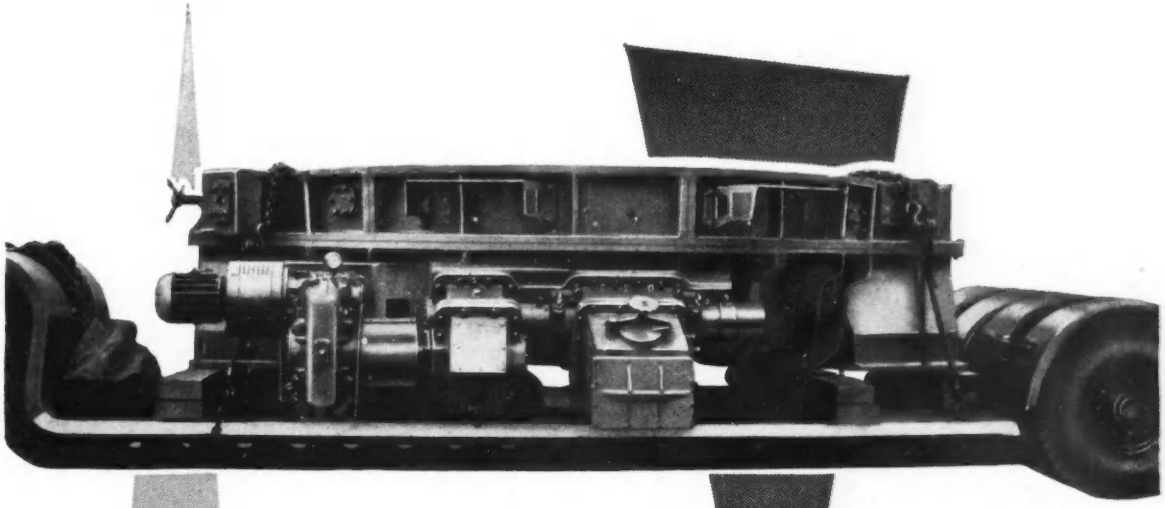

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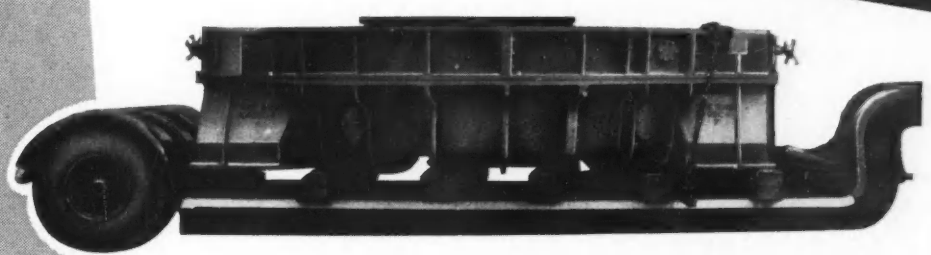

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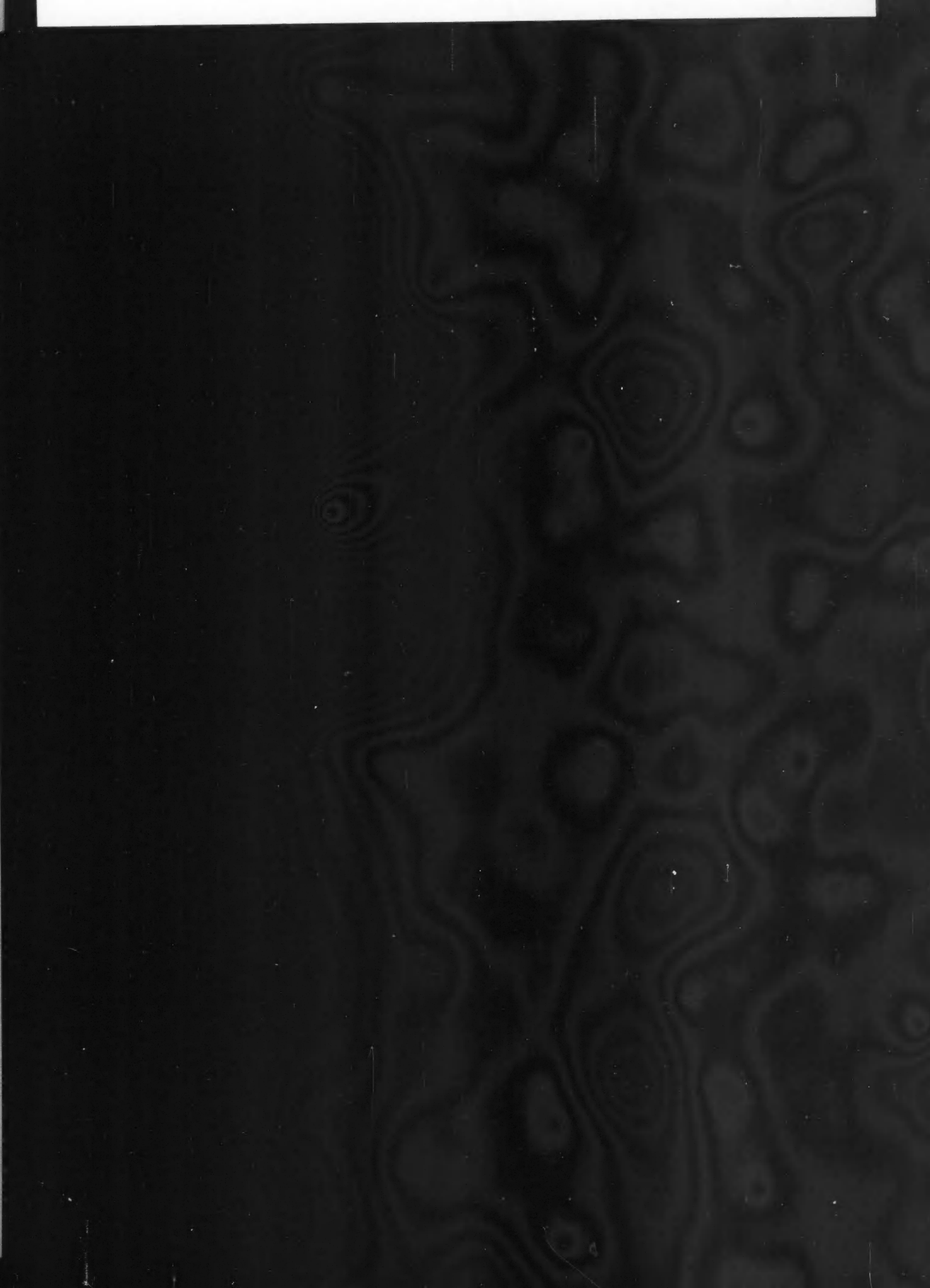
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